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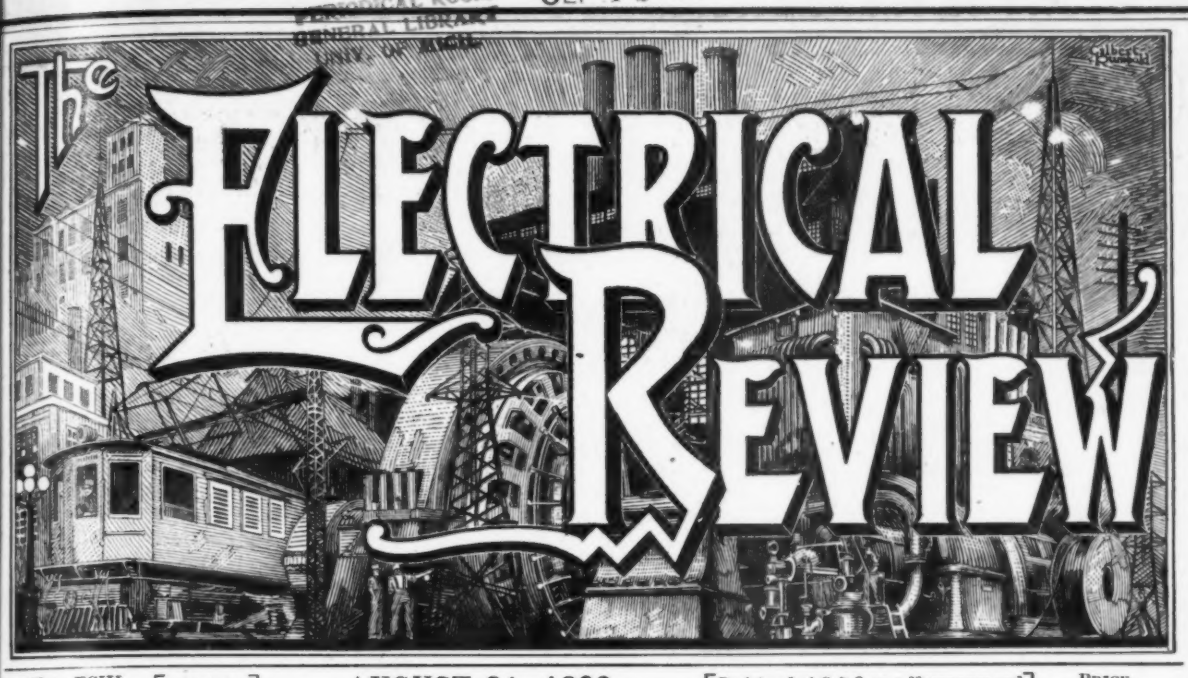

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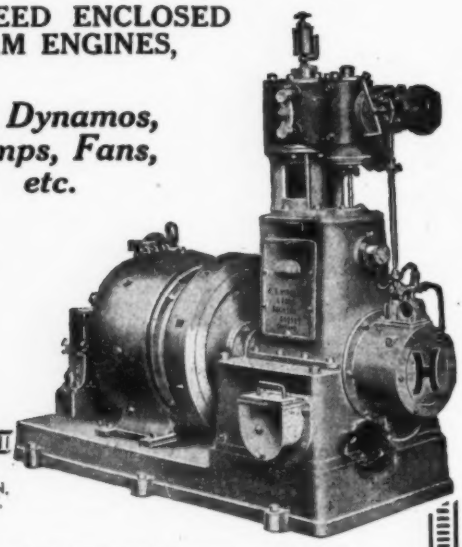

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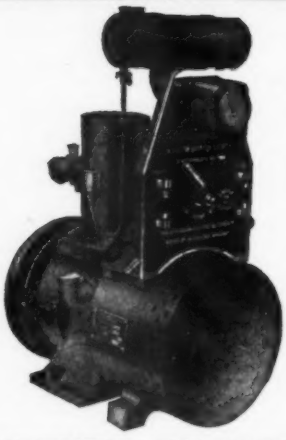

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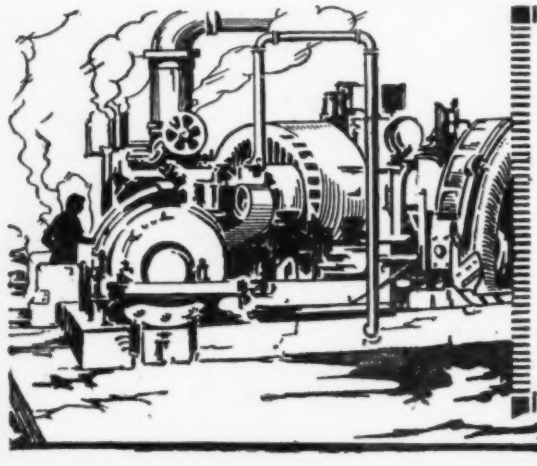

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THE "WIRELESS CONTRACTOR."

NUMEROUS forecasts of the substance of the Broadcasting Committee's Report have appeared in the daily Press, but up to the time of writing the Report itself has not been published. Our advice to electrical contractors is: Don't wait for the Report, or for Government action upon it, but take steps to prepare for an autumn and winter wireless campaign, just as every far-seeing contractor will shortly be reviewing and supplementing his stock of electric fires. As soon as Greenwich Time takes the place of summer-time, the interest of the public in wireless reception will begin to revive, and the wiring contractor who is not ready to offer wireless sets to his customers at the right moment will find, as last winter, that the big departmental stores, the small new wireless shops which have survived the slack summer season, and the garages, not to mention the music shops, will obtain the business. Although there may not this year be a sudden boom, it is safe to predict a substantial increase in "listeners-in," and an early and increasing demand for apparatus.

It may, however, be advisable to consider in what manner the report will be likely to affect the contractor's general policy with regard to wireless, and whether it should deter him in any way from carrying on just as if existing conditions and regulations were to continue. So far as Government action is concerned, it seems unlikely that the technical design of apparatus which may be used by the public will be affected. In any case, the rule limiting the use of reaction by the general public need neither be relaxed nor rendered more restrictive, and whatever may be the new conditions as to licences, the present patterns of B.B.C. sets will still be suitable for reception. Some modification with regard to the nature of licences is, of course, almost bound to take place as a result of the report, so soon as the necessary new agreement has been arrived at between the Post Office and the Broadcasting Company, but it is obvious that the Post Office would not withdraw or restrict the powers of the holder of an ordinary broadcasting licence granted before the issue of new regulations. Nothing at present prevents a contractor's customer from obtaining such a licence at a Post Office as hitherto, with the certainty that it permits him to carry on for a year at any rate with receiving sets of the present approved types. There is further no likelihood that the British Broadcasting Company's programmes, which incidentally have been particularly good during the past week, will deteriorate in quality; in fact, from what we have seen of the company's policy, it is more likely that it will continue to introduce new features and improvements. Consequently, the only reasons which the contractor could have for not carrying on with his autumn preparations as if the Broadcasting Committee had not sat at all, are those connected with the price of the apparatus. This raises a more difficult problem. There has been considerable agitation to have the B.B.C. fee placed on wireless sets either abolished, reduced, or conceived on a different basis, and the advocates of what the supply-station engineer would call a flat rate, namely, a fixed price for the licence to cover the whole fee, irrespective of whether the licence-holder works with a crystal set in a match box or a seven-valve set in an inlaid cabinet, will probably win the day. Much will, of course, depend on the Broadcasting Company's attitude to the report. The adoption of a flat rate would reduce the price of wireless sets by the amount of the present tax, and the B.B.C. would be expected to

make effective arrangements by which dealers holding stocks could recover the amount of the taxes which had been remitted. On the other hand, existing licence-holders at the time of the change who had not yet bought their sets would represent a loss to the B.B.C. if the tax on existing stocks of sets were refunded, and customers who purchased sets at the present time would also expect a refund if the fee were abolished in the near future. This difficulty does not appear insuperable, however, and it would appear probable that a fair arrangement would be made with regard to existing stocks and immediate sales, the Broadcasting Company relying on the increasing revenue from the issue of more licences when the present uncertainty as to the Government's policy with regard to experimental licences is removed.

The delay necessary for new regulations consequent on the Broadcasting Committee's Report should therefore occasion no corresponding delay on the part of the electrical contractor in formulating his autumn and winter programme. Taken as a whole, wiring contractors benefited very little by the wireless boom last year, because they were not ready to take advantage of it. Their regular bread-and-butter business of house wiring is still slack, and we trust, therefore, they will be tempted into a more progressive policy for the coming season. In the Provinces we believe the wiring contractors have shown more interest in wireless than in London, possibly owing to the competition in the Metropolis by the large shops and the greater facilities also in London for intercommunication of ideas between amateurs desiring to build their own sets. In London, as in the Provinces, however, there should be a good field for an extension of the wiring contractors' activities, and those who have ignored the subject of wireless altogether so far would be well advised to make a study of it.

Besides the sale of the apparatus itself, a large business should certainly be done in the erection of aerials. The early enthusiasts may have fixed up their own for the most part, but, as the number of listeners extends, it will be found that the proportion of newcomers who will want this done for them will increase. To be able to fix up back-garden aerials on the shortest notice requires only a stock of wire, insulators, leading-in tubes or cab-tire cable, and tubular masts, together with a few spreaders and stays and the necessary ironmongery for fixing; but the main equipment which the contractor will want is the ability to be able to furnish estimates and quotations on the spot.

In selecting the types of apparatus which he will stock and sell, the contractor new to wireless will be well advised to indulge in some experimental work himself. Listeners, it is true, speak of being able to "get" London, Birmingham, Glasgow, or Paris, as the case may be; it sounds as easy as getting influenza, but, like the 'flu, there are vast differences in intensity and quality once the thing is got, especially in the case of valve sets and still more when loud speakers are used. The contractor can follow the safe rule that he will best be able to sell the set which he himself can manipulate with the best results. He will find that the high-frequency stage no longer presents the difficulty which it did in the early days, and its adjustment in the present B.B.C. sets is comparatively easy. On the other hand, it is the simplicity of the low-frequency amplifying stage that has led to the large number of coarse-toned sets on the market and the distorted reproductions in the bulk of the loud-speakers in use. It is a fact that has now been well established by experiment that the greater part of the distortion in a loud-speaker is produced by the low-frequency amplification that precedes it and not in the loud-speaker itself. A bad loud-speaker will be discordant with any set; but a good one which, when used on a well-designed and proportioned circuit, reproduces speech and music with almost the same purity as the tone transmitted into the microphone at the broadcasting station, may distort horribly on another circuit or transformer. Another question which will probably give rise to much conflict of opinion and friendly rivalry is the relative merits of the ordinary valve and the "dull emitter." So far there is not much information from independent listeners as to the performance of the latter, and the contractor will be well advised to convince himself which of the two types of valve gives the better reception. In view of the recent reduction in price, the dull-emitter should be the more economical to use, for, although it costs the user who charges his accumulator from the supply mains in series with a resistance or electric fire no less to charge one cell than three, his accumulator will cost him only one-third as much, and he will also save considerably on the diminished frequency of valve renewals.

The contractor who has been following the advances in wireless may feel somewhat disturbed from the business point of view by the advent or resuscitation of the various dual-amplification circuits. There is still a good deal of experimental work to be done on these, however, before they are simplified and standardised sufficiently for use by the ordinary layman, and the Post Office approval will also take time. It does not seem likely that their general and sudden adoption will create a quantity of bad stock in the shape of existing patterns any more than the coming of the metal-filament lamp caused wholesale scrapping of carbon-lamp stocks. In a progressive industry, a risk such as this is always present, but seldom has the anticipated effect. When wireless telegraphy was first invented, there was a terrific slump in submarine cable shares, but even now new cables are being laid across the Atlantic, although England and America have been in commercial wireless communication for many years.

Wireless work, even if only a side-line for the wiring contractor, cannot but be interesting, and, if dealt with seriously, should also be remunerative.

The Shipping, Engineering, and Machinery Exhibition.

One of the most important events in the engineering world is the Exhibition which opens at Olympia to-day for a period of three weeks, and a glance at the preliminary list of exhibitors shows that electrical firms appear to recognise in this an opportunity for increasing their business. Of the total of about 250 firms, at least 40 are showing electrical equipment and appliances, or apparatus intimately connected with the electrical industry. These are quite apart from firms employing electric drives or using electricity in a secondary way.

That the exhibition is of the first importance is evidenced by the number of official visits which are to be paid by various bodies. With the notable exception of the Institution of Civil Engineers, practically all the leading engineering institutions appear in the list, as well as other professional and industrial organisations. In addition to the main exhibition, there is a special section, organised by the Society of Motor Manufacturers and Traders, Ltd., showing motor boats, marine, and stationary internal-combustion engines, and accessories. In this, too, we notice the names of some electrical firms.

A number of advance descriptions appearing in the "Bulletin" issued by the organisers foreshadow an interesting, useful, and representative display which will be fully worth visiting.

British Trade in Egypt.

The extent of Egypt's import trade in electrical and allied goods was shown in detail in our issue of April 20th.

Although the market is not large, it is growing, and is therefore worth cultivating. Yet British sales generally in Egypt have declined in recent years. Mr. E. H. Mulock, British Commercial Agent in Cairo, comments on this decline in a report which has just been issued by the Department of Overseas Trade.* He hopes that United Kingdom manufacturers will not

* Price 1s. 6d. H.M. Stationery Office.

delude themselves into thinking that they are in no way to blame for this shrinkage of British trade. In his opinion the comparison of British and foreign commercial activities and methods of business clearly indicates that, *inter alia*, the lack of consideration for, and support of, their agents or representatives, as well as the apathy towards the Egyptian market, that are shown by many British manufacturers, are to an appreciable extent responsible for the success of their foreign competitors.

Engineering works capable of producing spare parts for machinery, boilers, and pumps have developed considerably in Egypt since the war; at Alexandria and Port Said there are several shipbuilding and repairing works, and the Commercial Agent says that the progress in building rolling stock made by the State Railway Carriage Workshops in Cairo is astounding, though the underframes and bogies still have to be imported from abroad.

"Preferential" Tariffs.

In our "Correspondence" columns to-day Mr. W. G. Newberry draws timely attention to the fact that "preferential tariffs," like some other things, are not always what they seem. The methods adopted by some of the Dominion Governments for assessing the values of imported articles for the purpose of calculating the duty payable in many cases result in Customs charges which not only wash out the so-called preference, but actually place the British goods at a material disadvantage in competition with foreign products. This condition obtains, of course, only in respect of goods which are sold also in the home market; articles which are made solely for export have no "domestic" value, and the duty therefore is based upon the invoice price.

We strongly advise readers who are interested in export trade with the Dominions to read Mr. Newberry's articles, referred to in his letter, if they have not already done so.

A Shop-window Lighting Campaign.

The supremacy of the electric light over all other artificial illuminants being no longer disputed, even by competitors, perhaps we electrical people are inclined sometimes to overlook the possibilities of further developments in this direction. However, a communication received from the E.D.A. this week offers a useful suggestion for turning a non-paying lighting proposition into a remunerative one. The E.D.A. communication referred to sets out a scheme of advertising which it is about to launch, having for its purpose the promotion of late shop-window lighting. Shopkeepers' papers in every trade which lends itself to window display will carry the E.D.A. advertisements, and to back these up, a new pamphlet has been got out on the lines of the now familiar "Silent Salesman" (of which over 60,000 have been sold), setting forth some new arguments, as well as re-stating the old ones, in a striking cover that will attract the attention of shopkeepers.

The ordinary *short-hour* shop-window lighting is not a satisfactory load for the central station, so it is not likely that many engineers will fail to buy these pamphlets and circulate them among their consumers. This movement has been spreading quietly for the last two years, and many notes have appeared in our columns regarding undertakings which have laid themselves out to get this business. It is a load that widens the peak without increasing its height, and therefore can be welcomed even on systems whose mains and services are already loaded to their fullest extent. It will provide a steady run of small but profitable jobs for the contractor, and a more frequent renewal of lamps.

From the point of view of the community at large, this campaign, if vigorously and successfully pressed, will add enormously to the brightness and cheeriness of our towns, and everyone, except undesirables, will be rejoiced to see our streets a blaze of light instead of channels of shuttered darkness.

To end on an electrical note, the value of this electrical "atmosphere" is by no means to be despised.

Prices and Profits.

In this issue is concluded a critical examination, by Mr. H. M. Sayers, of the present position with regard to the prices charged for electricity supply and the profits which are being made by the undertakers. To review the whole industry would have been a colossal task, and therefore the author has confined his attention to selected examples; but the data which he has used still cover a wide range, and may be accepted as fairly representative of the mass.

That our supply undertakings should be prosperous is a most desirable condition; concerns which can barely pay their way give little satisfaction either to their consumers or to their owners, and are unable to take part in the campaign for the development of electricity supply of which the Electricity Commissioners are the protagonists. We therefore unfeignedly rejoice in the present thriving state of the industry. But there is another aspect of the question which must not be ignored—there is nothing that so stimulates the demand for electricity as a low price per kWh; and to-day, when the public is awakening to the wide field of usefulness of electricity in the home, and is urged on by the scarcity of domestic servants, supply undertakings have an unprecedented opportunity for development, provided that their charges are reasonable. We therefore commend Mr. Sayers's article to the attention of our central-station readers in the hope that thereby they may be induced to give this matter careful consideration.

Inter-Scandinavian Transmission of Power.

During the past two years a commission composed of State representatives of Norway, Sweden, and Denmark has been engaged on an investigation of the question of the electrical transmission of energy from Norway to Denmark, the inquiry being divided among three sub-committees. The technical sub-committee, which has now completed its report, has put forward alternative schemes to give effect to the project. In the first place, the committee foresees the possibility of transmission by means of direct current with a cable from Norway under the Skager Rack and thence to Copenhagen and Aarus. The pressure contemplated is 200,000 volts, and the sources of power to be used are those of the Kviken or the Otra. In the second place, the proposal is for a direct-current transmission by means of an overhead line across Sweden and a cable from Helsingborg to Jutland. The use of the source of the Nore has been taken into consideration in connection with this transmission route. A further scheme projects the erection of an alternating-current line through Sweden with a cable or overhead line over Oresund, the pressure being put at 132,000 volts. It is calculated that the maximum power to be transmitted would be 150,000 horse power. The committee is unanimously of opinion that the transmission would be technically and economically feasible. A cable from the South of Norway to the northern point of Denmark would have a length of 80 miles, but this transmission scheme would be confronted with many difficulties owing to the depth of the sea (which is up to 600 metres) and the difficult weather conditions. The joint commission will take the report into consideration in the near future.

THE OPERATION OF INDUCTION MOTORS AT DIFFERENT FREQUENCIES.

By H. COTTON, M.Sc.

At the present time a great deal of attention is being given to the problems involved in a change-over from one system of supply to another. In some cases the change is from direct to alternating current, in others from alternating current of one frequency to another. In the second case the most difficult problem is to decide what to do with the induction motors, whether to replace them by new ones, whether to rewind them for the new frequency, or whether to run them at the new frequency without any change.

Before discussing the new conditions of operation of the motors, it is advisable to state briefly the properties of the circle diagram of the induction motor, since this diagram enables a fairly simple solution of the problem to be obtained. The diagram in its simplest form, *i.e.*, for an ideal motor without losses, is shown in fig. 1. When the motor is running on no load, the current per phase is represented by the length OA. This current is, in an ideal motor, the magnetising current; that is, its only function is to produce the magnetic flux. It does no useful work, and it is therefore in quadrature with the voltage, which is represented in phase by the perpendicular OY. If load is put on the motor, and this load is gradually increased, the extremity of the current vector travels along the circumference of a semi-circle until finally, if the motor is stalled and full voltage applied, the current is represented by OB. Thus B is the standstill point and OB the short-circuit current. Now, when the motor is stalled, it behaves like a transformer on short circuit, and therefore the value of the short-circuit current OB depends upon the amount of primary and secondary magnetic leakage. The leakage factor of the primary is the ratio of the total primary to the useful primary flux; similarly with the secondary. Calling these two ratios v_1 and v_2 respectively, we have

$$v_1 v_2 - 1 = \text{the dispersion coefficient } \sigma.$$

It is shown in the text-books that the ratio of the short circuit to no load current is equal to $(1+\sigma)$ to σ. Thus if the diameter of the circle is unity, the length of the no-load current vector OA will be σ. Suppose the load is such that the working point is at P, then the current will be represented by OP, the power factor by the cosine of the angle YOP, and the output by the perpendicular PM. The maximum power factor occurs when the working point is at Q, such that OQ is tangential to the circle. It is easily proved from this that the maximum power factor is equal to $1/(1+2\sigma)$. Finally the maximum output in the case of the ideal motor is proportional to the maximum ordinate, that is, to the radius of the circle.

In order to investigate the effect of changed conditions on the motor, it is therefore necessary to find out how the new conditions alter the circle diagram. Suppose the old motors are run at the new frequency, and assume that the voltage remains as before, which is almost certain to be the case; let E be the voltage per phase, f the frequency, ϕ the flux per pole, Z the conductors per phase, and k a constant depending upon the arrangement of the winding; then

$$E = k\ \phi\ Z\ f \times 10^{-8}$$

and therefore ϕ is proportional to $1/f$.

Thus, if the frequency is doubled as, for example, in a change over from 25 to 50 cycles per second, the flux per pole is halved. The torque developed by the motor is proportional to the product of the flux and current, so that for the same current loading the torque also will be halved. But the output of a motor is proportional to the product of the torque and speed, and since the speed is directly proportional to the frequency, whereas the torque is inversely proportional to it, we see that the output is the same in each case. Hence the circles for the two cases will be of the same radius and therefore of the same diameter. The magnetising current is inversely proportional to the frequency, so that the length OA for operation at 50 cycles will only be one half of the length OA for operation at 25 cycles. Hence if for comparison we call the diameters of the circles unity in both cases, then for the length OA we have σ for 25 cycles and $\frac{1}{2}\sigma$ for 50 cycles. The maximum power factors are therefore $1/(1+2\sigma)$ on 25 and $1/(1+\sigma)$ on 50 cycles. Thus suppose that σ is equal to 0.06, then the maximum power factors are 0.89 and 0.94

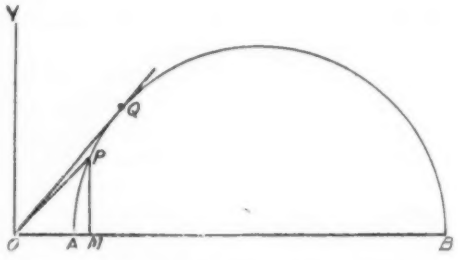

Fig. 1.—Induction Motor Circle Diagram.

respectively, the change-over to the higher frequency therefore giving the motor superior operating qualities in this respect. Also when we take the case of an actual motor in which the resistances of the windings are not negligible, we realise that the smaller magnetising current causes the motor to have a smaller copper loss when working at the high frequency.

The change to the higher frequency therefore improves the electrical operation of the motor. On the other hand, since the speed is doubled, the centrifugal force on the rotor conductors will be quadrupled. This may cause the mechanical factor of safety to be very small, especially with a large diameter rotor. With a small motor of modern construction there is not much danger of passing the safety limit even on the doubled speed. The above considerations therefore show that if it is imperative that some of the motors should run at the higher frequency without any alteration, they should be as far as possible only small ones.

We now come to the other alternative of winding the motors for the new frequency so as to have the same speed as before. The speed of an induction motor is inversely proportional to the number of poles, and therefore if the frequency is doubled, the number of poles must also be doubled. Hence if the magnetic flux density in the air gap, and therefore in the teeth, is kept the same as before the flux per pole ϕ will be halved, since the pole pitch is halved. But the frequency f is doubled so that from the equation

$$E = k\ \phi\ Z\ f \times 10^{-8}$$

we see that Z, the number of conductors, is unchanged. The number of conductors per pole is therefore halved. Now when the flux density is kept constant, the magnetising current is inversely proportional to the number of conductors per pole. In this case, therefore, the magnetising current is proportional to the number of poles, and therefore to the frequency. Thus with the operation on double frequency at the same speed as before, we have a doubled magnetising current. Again, the output of the motor is proportional to the product of the torque and speed. Since the speed is not changed, the torque must be unchanged if the output is to remain

the same. This is actually the case since although the flux per pole is halved, the number of poles is doubled, thus giving the same torque for the same current. The radii of the circles representing the operation of the motor before and after alteration are therefore the same. The doubled magnetising current will make the length OA for 50 cycles twice the corresponding length for 25 cycles, thus giving for the maximum power factor under the new conditions $1/(1+4\sigma)$. If σ is equal to 0.06 as before, this works out to 0.81, showing that the operation of the motor at 50 cycles will be inferior to its previous operation at 25 cycles. Again, the doubled magnetising current necessitates a larger total stator current for the same output, and this increases the copper losses and therefore the heating. In order that the heating should not be increased when the motor is rewound with a doubled number of poles, it is desirable to rewind with slightly heavier wire. This may make it extremely difficult to get all the conductors in the slots. This can be got over by removing the slot lining and substituting a somewhat thinner but higher grade lining.

THE CALCULATION OF HEAT BALANCES OF BOILER PLANT.

By CHAS. F. WADE, A.M.I.Mech.E., A.M.I.E.E.

The subject of heat balances has received considerable criticism in certain quarters, it being urged that such figures cannot be strictly accurate and are of but little utility when worked out. As a matter of fact, the heat balance provides an excellent basis upon which to calculate a fair bonus system of payment and, although not scientifically accurate, will be sufficiently so for the purpose to which it is to be applied.

A carefully worked-out and complete heat balance will show clearly in what way every heat unit entering the boiler house has been disposed of, and, if set out in diagrammatic form, will be intelligible even to the most illiterate of boiler firemen.

The laboratory data needed as the basis for calculation will be:—

Gross calorific value of the coal, air dried.
Percentage moisture in the fuel, as fired.
Percentage volatile matter ditto.
Percentage ash ditto.
Percentage carbon in the ash heap,

from which will be calculated—

Gross calorific value of the coal, as fired.
Approximate percentage hydrogen in the fuel.
Approximate percentage carbon in the fuel.
Percentage of original heat of the fuel in the ash heap.

In addition to the data obtained under laboratory conditions, the following additional information will have to be forthcoming:—

Percentage CO_2 in the waste gases.
Temperature of waste gases.
Continuous record of coal consumption.
ditto evaporation.
ditto feed temperatures.
ditto steam pressure.
ditto steam temperature.

A still test should also be made of one boiler of each capacity installed in order to determine the amount of heat lost by conduction, &c., usually mis-termed "radiation." This test is best carried out by carefully measuring the fuel used in order to keep the steam pressure of the boiler constant at a slight amount below normal working pressure, so as to avoid any possibility of blowing off. At the same time, the CO_2 percentage should be maintained at the highest possible figure and a record kept of it, as well as of the temperature of the waste gases. It may be best, in the case of chain-grate and similar stokers, to work the grates by hand for the test in question, the dampers being kept almost closed, so that the highest possible percentage of CO_2 is maintained.

If there is no leakage of steam or water, the water level in the boiler should not vary, so that no steam will be needed for feed purposes. If the water level does fall, it will be necessary to localise the source of leakage before the test can be proceeded with. The heat value of the fuel consumed, less the loss in the waste gases and ashes, will be the amount of heat lost by "radiation" for the period over which the test is carried out. This rate of radiation will be approximately constant, except for slight variations due to changes in boiler-house temperature, but for all practical purposes this variation may be neglected. The practice of taking the radiation loss as a constant percentage of the heat transfer, irrespectively of the rate of steaming, is obviously wrong, for the percentage will, of course, vary inversely as the rate of heat transfer.

The various items which will compose the heat balance will be as follows:—

HEAT BALANCE.

—	B.Th.U.	%	—	B.Th.U.	%
Heat in one pound of coal as fired	—	100	Heat recovered in boiler		
			do., do. superheater		
			do., do. economiser		
			do., do. air heater		
			Total recovery or thermal efficiency		
			Losses:—Radiation		
			Waste gases		
			Ash heap		
			Unaccted. for		
					100

Before proceeding to the consideration of complete boiler-house heat balance, it will be as well to deal with the calculations involved in that set out above, which only refers to the main units themselves.

In arriving at the heat of one pound of fuel as fired, the calorific value of the air-dried sample is first ascertained, and this figure is corrected by applying a reduction corresponding to the percentage of moisture determined in the air-drying test. This may be done by taking the coal sample for calorific test at the usual standard weight, less a percentage equal to the ascertained percentage of free moisture, and calculating the result as if a full-sized sample had been used. Otherwise the correction may be made after the calorific test.

Sampling of the fuel into airtight containers must be carried out at regular hourly intervals, and accompanied by a regular record of the amount of fuel consumed during the same periods, so that the actual amount of moisture fed into the furnace with the coal can be ascertained by calculation from the amount of coal fired under each condition of moisture.

The method of arriving at the heat recovery in the various units is too well known to need repetition here, except that the recovery in the air heater will be best ascertained by subtracting the sensible heat of the gases leaving the heater from the sensible heat of the same gases entering the heater.

The loss of heat by "radiation" has already been referred to, the calculation for heat-balance purposes being merely the application of the total heat dispersed

in this manner to the total heat of the coal fired and expressed as a percentage of one pound of coal.

There are two sources of loss invariably present in the waste gases, these being, first, the sensible heat of the gases themselves, and, secondly, the loss of heat in sensible heat and latent heat of the steam formed by the combustion of hydrogen or from the moisture in the fuel.

Although many tables and charts have been published showing the heat loss in the waste gases under varying conditions of temperature and CO_2 percentage, it must be borne in mind that the losses so shown only refer to the sensible heat of the waste gases from an average bituminous coal expressed as a percentage of the original fuel. In order to ascertain the true loss for the actual coal in use, it is necessary to have some information as to the carbon and hydrogen content, and, if extreme accuracy is aimed at, the percentages of sulphur, oxygen, and nitrogen. The calculations involved in arriving at the true losses are fairly lengthy and are really outside the limits imposed by this article. The actual hydrogen and carbon content of any fuel may be approximated very closely from proximate analysis by the application of the formula of Diederichs, which is as follows:—

$$H = V[7.35/(v + 10) - 0.013],$$

where H = % hydrogen in the combustible,

V = % volatile matter in the combustible.

Combustible = total fuel minus moisture and ash.

Carbon may be taken as combustible minus hydrogen.

To the hydrogen in the combustible estimated as above will have to be added that forming part of the moisture of the fuel, or one-ninth of the total moisture.

The heat carried away in the waste gases by the superheated steam produced by the combustion of the hydrogen in the fuel, as well as that due to the moisture, will be as follows:—

$$9H\,(212 - t) + 970.4 + 0.47\,(T - 212)$$

B.th.u. per pound of coal used,

where H = fraction of hydrogen in coal, by weight,

t = temperature of coal, as fired, °F.,

T = temperature of waste gases, °F.

As regards the loss of sensible heat, as disclosed by the percentage of CO_2 in the waste gases for a bituminous coal, we have first to ascertain what is the maximum possible percentage of CO_2 obtainable without excess or deficiency of air; this will depend upon the hydrogen content of the fuel, and can be estimated from the following table:—

Table showing Approximate Maximum Percentage of CO_2 with Various Percentages of Hydrogen and Excess Air.

Per cent. H in coal.	Percentage of excess air.					
	0	50	100	150	200	250
0	21·0	14·0	10·5	8·5	7·1	5·9
5	18·5	12·2	9·0	7·3	6·2	5·1
10	16·5	10·8	8·0	6·7	5·5	4·6
15	14·8	9·7	7·1	5·8	4·8	4·0
20	13·0	8·5	6·3	5·0	4·3	3·5
25	11·7	7·4	5·5	4·4	3·5	3·1

The sensible heat loss in the carbon dioxide formed by the combustion of the carbon in the fuel, as disclosed by ultimate analysis or calculation, is found by the following formula:—

$3.67\ C \times 0.23\ (T - t)$, B.th.u. per lb. of coal burned,

where C = fractional proportion of carbon in the fuel,

T = temperature of waste gases in °F.,

t = temperature of air entering furnace in °F.

The heat lost in the accompanying excess air will be—

$A \times 0.243\ (T - t)$, B.th.u. per lb. of coal burned,

where A = excess of air above that required for complete combustion, expressed as a fraction, T and t being as before.

The total loss in the waste gases will, of course, be the sum of the losses due to hydrogen products and the sensible heat of carbon dioxide and air. The loss due to the presence of carbon monoxide in the gases at intervals will be so small over any appreciable period as to be negligible.

The last item among the losses is that due to combustible in the ash heap, this combustible being practically entirely composed of unconsumed carbon, with a calorific value of 14,544 B.th.u. per lb. The loss on the ash heap per lb. of fuel will be—

$$A \times C \times 14{,}544/(100 - A) \times 100 \text{ B.th.u.},$$

where A = percentage ash in coal,

C = percentage combustible in ash heap.

In most of the heat balances put forward, the "unaccounted for" loss is of the order of 6 per cent. or thereabouts, but this is generally due to neglect of the loss in the waste gases due to moisture and hydrogen. Taking these losses duly into account, the ultimate result will not be far from 100 per cent. of the original fuel.

In working out a heat balance for the whole of the boiler-house plant, the whole of the power and lighting used will have to be reduced to terms of heat units at 3,440 B.th.u. per kWh. Again, the labour employed must not be lost sight of, and may conveniently be based upon the price of the heat units purchased in the coal (so many per penny), the wages of the men employed being calculated accordingly.

Efficiency bonus should be based upon those items on the balance-sheet which are controllable by the men, and which will include the ash heap and chimney losses, but will not include those of the latter which are due to the hydrogen in the coal. As the lighting, power, and labour will also be, to a considerable extent, influenced by the attention bestowed upon these items by the boiler-house staff, the bonus payments should also be regulated by these factors.

If the balance is conscientiously worked out, it will provide a ready means of indicating at once in what direction losses take place and how they may be reduced.

Electric Lamps in the U.S.A.—The total sales of tungsten filament incandescent lamps (excluding miniature lamps) in the United States during 1922 amounted to slightly over 200 million lamps—a 25 per cent. increase over the 1921 sales of 160 millions, and within one per cent. of the 202 millions sold in 1920. There were less than three million carbon lamps sold in 1922, compared with six millions in 1921 and nine millions in 1920. It is apparent that the carbon lamp will soon disappear from the market; it is now a negligible item in the total lamp sales. Manufacturers have developed a colouring material for lamps which has been very satisfactory. It is sprayed on the lamp, is weatherproof, and does not fade. It is even more uniform in colour than natural coloured glass bulbs, which vary in colour, due to the variation in density and thickness of individual bulbs. Sprayed coloured lamps can be supplied more quickly than natural coloured glass lamps, as the sprayed colour can be quickly applied to clear lamps in stock, whereas the natural coloured glass lamps usually have to be made to order and often the bulbs have to be specially blown. Only four colours are supplied, which are a standard shade of red, blue, green and yellow. The sprayed coloured lamp is no more expensive than dipped coloured lamps and is cheaper than natural coloured glass lamps. The sprayed colour can also be satisfactorily used on Mazda C lamps up to and including the 150-watt size.—*Transactions*, I.E.S.

Plant Stimulation by Light.—According to the *Transactions* of the I.E.S., Dr. William Crocker, research director of the new Thompson Institute for Plant Research which Col. William B. Thompson is establishing in Yonkers, U.S.A., at a first cost of more than $500,000, intends to use powerful electric lamps to supplement sunlight in growing plants. Eventually the institution is to cost $2,500,000.

"This new institution with its gardens, greenhouses and laboratories," said Dr. Crocker, "is to be to plants and flowers what the Rockefeller Institute is to humanity. In other words, it is to study and try to cure diseases of plants and flowers and other vegetation." Dr. Crocker has had wide experience as head of plant physiology at the University of Chicago. On the board of trustees is the scientific group, including Prof. John Coulter, of the University of Chicago, Prof. L. R. Jones, of the University of Winconsin, Dr. Raymond Foss Bacon, consulting chemist of New York city, and Dr. Crocker. The laboratories are to be located on a nine-acre plot at 1086 North Broadway, Yonkers. In these chambers, the temperature, humidity, carbon dioxide concentration of the air and the quality, intensity and duration of light will be adjustable at will and automatically maintained. In other words, the experimenter will manufacture climate and atmosphere to suit the needs of the experiments.

COMMERCIAL WIRELESS TELEGRAPHY IN SOUTH AMERICA.

A Consortium of Powerful Interests.

(From Our Special Correspondent.)

The present year promises to rank as *annus mirabilis* for wireless telegraph progress; before it expires, an operating system will be put into force linking up the countries of the world by the free exchange of air commercial messages. In this enterprise both British and North American capital is being employed almost exclusively, the sum already invested exceeding $20,000,000, of which nearly two-thirds has been, or will be, found by the Marconi enterprises established in the two hemispheres.

Whereas British interests in this company for South America have been largely acquired by the General Electric Co., U.S.A., those of the United States have been taken over by the Radio Corporation of America, and these two powerful corporations are now working in combination. The aim in view is to co-operate vigorously both with Governments and national commercial interests, while preserving free and independent communication with all parts of Latin America as well as with other foreign and more distant trade centres. The radio stations operated include the transmitting depôt at New Brunswick, Canada, and the receiving station at Belmar, New Jersey (U.S.A.); they are being used for the British and South American services. Marion (Mass.) and Chatham (Cape Cod) receive from France, Hawaii, Japan, and China, the sending and receiving stations being at Balinas and Marshall, near San Francisco.

The work on long-distance wireless stations at Maschwitz and Lujan (Argentina) has made remarkable progress. Through these the premier South American Republic is enabled to avail itself of the new service. The whole of the radio business of that Republic has been under the control of Captain Powhatan Page, a former officer in the Argentine Navy. Argentine and South American interests were also represented through Dr. Benito Villanueva and Dr. Horacio Beccar Varela, while Major Charles B. Bruch has been in charge of the Radio Corporation's affairs in South America, with his operating centre in Buenos Aires.

The close of last year witnessed the formation of what may be regarded as a wireless consortium, projected and organised by Senatore Marconi. This consortium consists of the Radio Corporation of America; the Compagnie de Télégraphie sans Fils, of Paris; the Telefunken Co., of Berlin; and the Marconi Co., all of which are actively interested in South American wireless telegraphy. Four years ago a German-Argentine company (Gesellschaft für Drahtlöse m.b.H.), financially supported by the German Government, obtained a concession from the Argentine Government for the right to build, near Buenos Aires, a high-power station for communication with North America and the whole of Europe. The finishing touches are now being given to this station, which is expected to be opened this month (August), and will then form the nucleus of the important consortium referred to, which has for its object the establishment of wireless telegraph companies throughout the length and breadth of South America. The second largest station in South America in connection with this enterprise will be erected at Pernambuco (Brazil). Construction progress is already reported. While the Buenos Aires station at present alone combines all the inventions of the four great radio companies, each succeeding station in South America will have the same advntage.

The plan to form a number of national companies has been first put into execution in Argentina. Here a company has been organised with a capital of $14,500,000, divided into $4,500,000 of "A" preferred shares (entitled to a non-cumulative 7 per cent. dividend); $6,000,000 of "B" preferred shares; and $4,000,000 of ordinary shares. Of this capital, the German-Argentine company will take $3,000,000 in "A" shares as the purchase price for its high-power station, and $1,500,000 has been earmarked for working capital.

The payments to the German group do not, however, end here. Other classes of shares will be divided equally between it and the participating companies, acting through trustees by themselves nominated. The $6,000,000 "B" shares will also be entitled to a non-cumulative dividend of 7 per cent., and after this distribution has been made, the balance of profits will become divisible as to 20 per cent. among holders of the "A" shares, 20 per cent. among holders of "B" shares, and the balance of 60 per cent. will go to the holders of the ordinary shares. Both "A" and "B" classes will carry 20 per cent. of the voting power, while the ordinary shares will hold 60 per cent., such percentages corresponding to the dividend rights in the surplus profits.

The Gesellschaft für Drahtlöse m.b.H. will receive $4,500,000 in "B" preferred shares and one-quarter of the ordinary shares, but, on the other hand, will transfer $100,000 of "B" shares to each of the other three groups, each of which will then hold $1,500,000 of "B" preferred shares. It will be observed that the German company comes off remarkably well, since it will not only realise $3,000,000 in cash, but will hold $1,500,000 of "B" shares as well as one-quarter of the ordinary shares. The control of the Marconi-Argentine subsidiary (the Compañia Marconi de Telegrafie sin Hilos del Rio) will be formally transferred to the trustees of the consortium.

UNIFORMITY IN COMMERCIAL PRACTICE.

By F. W. POPE.

Uniformity is, in many phases of life, the least desirable thing. In commercial practice, however, and particularly in the rendering and paying of accounts, the need for a measure of uniformity is evidenced in several ways. Just as one cheque is much the same as another and can be drawn and presented in the same way, so the various transactions which are entered into every day might be brought into line with each other, according to the particular customs of the different branches of industry.

One good sign is to be observed in the large, and increasing, number of firms which provide a form of receipt on the back of their cheques. This device, besides being thoroughly efficient, may be recommended as a simple and economical method. The one proviso that might be made is that the bank pass book should be agreed with the firm's cash book every month, but as this should be done in any case, it is hardly necessary to call attention to it here.

My present consideration is commercial practice as between firm and firm; my endeavour is to give expression to the need of some generally agreed way in which

transactions might be conducted between buyer and seller. Quotations, orders, invoices, payments, packing charges—all these details apply to almost every sale in any of the manufacturing trades, yet every firm has its own peculiar methods and requirements.

Let it be said at once that quotations should always include delivery charges to customer's address or British port and each quotation should be numbered as a means of reference for both parties. Where several similar machines are quoted for at the same time, confusion may very easily arise unless such a safeguard is adopted.

The order form needs to be printed so that a mark of reference, indicating the works order or other purpose for which the goods are required, may be written against the serial number. Order forms are of every possible kind, and the lists of instructions found upon many of them are, in their variety, not a little bewildering. As suppliers, many people insist upon "strictly net" terms, with a request that payment shall be made on a certain day of the month following delivery; as purchasers, the same people may (and often do) stipulate for 2½ per cent. discount and payment at the end of the month following delivery. No accountant can fail to have noticed numerous instances of this. The co-operation of trade associations must be sought before any solution can be found. They, by circularising their members and obtaining copies of order forms used by members, will be able to find a level on which most are agreed. Further, the drawing-up of a suggested standard order form would place their findings on a practical basis. A uniform statement of terms on the order has its value in the fact that the order controls the whole transaction.

With advice note and invoice, standardisation of procedure rather than of form is necessary. The first should be sent the same day as goods are dispatched, the second on the following day at the latest. This generally adopted, would help the accounts departments of both parties, and, while not entailing any increase of work, would make for a higher standard of efficiency. The practice of sending, at the end of the month, one invoice covering several consignments, leads to disorganisation at one end and delayed settlement at the other. It is, of course, essential that the customer's order number and reference be quoted on advice and invoice.

It would, no doubt, be preaching to the converted to say: point out errors in your favour as well as those against you.

It is difficult to understand why so many firms never send statements. The monthly statement of account is the only means of checking the buyer's with the seller's entries for the month concerned, and where invoicing has been kept up to date, there is no reason why statements should not be dispatched before the fifth of the following month.

While there may be many ways of rendering packing charges, there is only one accepted way of dealing with them, and that is by striking them off the invoice. Here all interest in them—from many a customer's point of view—ceases. "No one was ever put into court for non-payment of packing charges" seems to be a not uncommon impression.

Accountants know that the question is not an unimportant one; that it is, in fact, one upon which trade associations, in dealing with the whole subject of business practice, would be wise to make a simple declaration.

THE MUNICIPAL TRAMWAYS ASSOCIATION (INC.).—II.

ANNUAL CONFERENCE.

The Conference, which was held in Portsmouth last week, was a highly successful affair, no effort being spared to make the stay of the 400 odd delegates and ladies as pleasurable as possible. It happened that the period of the Conference coincided with "Carnival week" at Southsea, so that there was a certain "liveliness" about the naval port—of a different kind to that with which it was associated a few years ago. The proceedings on Tuesday and Wednesday were recorded in our last issue, but owing to shortness of time the discussion on the paper by Alderman Clark, of Rochdale, on "Tramways as a Municipal Asset" was put off until the following day, and here again there was another change, welcomed, it must be said, by the majority. It was intended to have the discussion on Alderman Clark's paper and the reading and discussion of a paper by Mr. R. S. Pilcher in the morning, and the annual general business meeting of the Association in the afternoon. It was found, however, that many of the delegates desired to accompany the ladies on a trip to Goodwood, which had been arranged for the afternoon, and so it was decided to get through all the remaining business on Thursday morning. The result was a curtailment of the discussions on the papers and possibly, judging from what was said, a slight curtailment of discussion upon certain points at the business meeting. As things went, however, the proceedings at the annual meeting, although private, were of a more or less formal character, and it cannot be said that anything of a vital nature was omitted. It was unfortunate that the weather should have broken down so badly for the trip to Goodwood. On Friday, August 24th, there was a steamer trip round the Isle of Wight. On the afternoon of Wednesday, August 22nd, a visit was paid by the ladies—we believe a few of the gentlemen succeeded in attaching themselves to the party—to H.M.S. *Barham* in Portsmouth Harbour. Everything possible was done by the Portsmouth people to make the Conference a success in every way, and they fully succeeded.

At the annual general meeting on Thursday, Mr. J. Barnard (general manager, Bolton) was elected President and Alderman C. Higham (Blackburn) Vice-President. Vacancies on the Council were filled by the election of Alderman Craddock (Wolverhampton), Alderman Bowes (Manchester) and Councillor Willoughby (Hull), together with Mr. A. Baker (general manager, Birmingham) and Mr. W. Chamberlain (general manager, Oldham). The annual dinner was held in the evening of the same day.

Birmingham's Experiment with Trolley Omnibuses.

By Alfred Baker (General Manager, Birmingham Corporation Tramways). (*Abstract.*)

A mild sensation was caused in the tramway world towards the end of the year 1921, by the announcement that Birmingham had decided to abandon one of its tramway routes and to substitute therefor some other system of traction. The opponents of tramways were of course highly delighted, and immediately saw in this the end of every tramway in the country, notwithstanding the fact that the capital invested in tramways in this country amounts to no less a sum than £86,000,000, and that tramcars in the year 1921 carried approximately 5,000 millions of passengers at a cost per passenger far below the rates charged by any other transport system in existence. There is no system yet devised that can cope with rush hour traffic with the same ease and facility as the tramway, and instead of tramways being dead, they are as alive to-day as they have ever been, and will hold the field for many years against all other known systems in dealing expeditiously with large volumes of traffic.

It is the object of the paper to explain the reasons which led the Birmingham Corporation to pull up one of its tramways and substitute another system in its place. In the year 1921, the Birmingham Corporation was faced with the reconstruction of a very large amount of permanent way, a matter, at that time, of grave concern to all tramway undertakings—

having regard to the high cost of wages and material, as compared with pre-war costs. At prices then obtaining, it was only on routes carrying an enormous amount of traffic that reconstruction could be faced without anxiety, particularly in those cases where the original loans in respect of permanent way had not been paid off. The Corporation was actively employed in reconstructing certain heavily-trafficked main routes, and, notwithstanding the enormous cost, the question of the desirability of so doing never arose. On the other hand, there were certain other routes requiring reconstruction where, as in the case of almost every large system, the traffic was comparatively light.

The Nechells route was one of these lean routes, and it was only when this tramway route got into such a bad condition that it was no longer possible to put off dealing with the matter that the question arose as to whether, having regard to the excessive cost involved and to the fact that the tramway was only a single line tramway, with loops, running through narrow thoroughfares where there was no possibility of carrying out street widenings to enable the lines to be doubled, there was any alternative system that might be adopted.

Practically there were only two alternatives that could be considered, *viz.*, the petrol omnibus and the trolley omnibus, and after exhaustive inquiries and much consideration, it was decided to adopt the trolley 'bus as being the most suitable system to apply to this particular route.

In considering the relative merits of the petrol omnibus and trolley omnibus vehicles, the following points had to be closely considered:—(1) Carrying capacity; (2) operating expenses; and (3) comfort of passengers as compared with that provided by double-deck tramcars.

The question of carrying capacity was very important. The tramcars running over the route were double-deck top covered vehicles carrying 54 passengers. It seemed to the Corporation that any new vehicle adopted must be able to seat passengers approximating in number to those carried on the tramcar. This at once seemed to point to the double-deck petrol omnibus of the later type as being the only vehicle possible, inasmuch as the majority of the trolley 'buses running in this country were single-deck vehicles carrying only from 20 to 30 passengers. Mr. R. H. Wilkinson, of Bradford, was experimenting with a double-deck trolley vehicle carrying about 50 passengers in that city, and readily gave full details of his vehicle and every facility for inspection during its trials.

Naturally, the most important question of all was the one of operating costs. These were known with regard to both tramcars and omnibuses, but the cost of running double-deck trolley vehicles of large seating capacity was not known, as no vehicles of this type were in regular service in other towns. The knowledge it did possess, however, led the Tramways Committee to believe that operating costs would certainly be less than petrol omnibus costs, and having regard to the fact that there would be no track to maintain and that this system would still remain a customer of the power station, the committee came to the conclusion that it would be possible to operate at a figure approximating to the cost of tramway operation.

The following estimated figures were put forward:—

		£
To reconstruct the Nechells tramway for a continuance of tramway traffic would cost		90,000
To install trolley omnibuses would cost:—		
12 trolley vehicles	£36,000	
Alteration to overhead lines	3,000	
Taking up tramways and making good the tramway route for ordinary vehicular traffic	15,000	
	54,000	
Less: value of 12 tramcars, transferred to other routes	18,000	
		36,000
Estimates of receipts, &c.:—		
Tramways.		
Receipts—based on previous years		28,300
Expenses, 80 per cent.		22,640
Gross profit		5,660
If the amount required for reconstruction was made the subject of a loan, the interest and sinking fund charges would amount to ...		9,000
Loss		3,340
Trolley 'Buses.		
Receipts		28,300
Expenses, 80 per cent.	£22,640	
Less: saving 1½d. per mile. P.W. repairs	1,562	
		21,078
Gross profit		7,222
Interest and sinking fund charges		4,100
Profit		£3,122

The proposal was approved by the City Council, and the preliminary work was immediately put in hand.

After very careful consideration of design, orders were placed for 12 trolley omnibuses.*

The old tramway lines on the Nechells route were pulled up, the road surface was restored and the line opened for traffic on November 27th, 1922. The actual cost of pulling up the tramway and reinstating the carriageway came out at about £9,000 or £6,000 less than the figure originally estimated.

The new system immediately "took on" with the public. The trolley 'bus gives the passengers a most comfortable ride with an entire absence of jerks, such as must be experienced with gear change driven vehicles. It runs with extreme smoothness and is practically noiseless. Indeed, in the author's opinion, there is no vehicle in transport service to-day that for ease and comfort, can compare with a properly constructed trolley omnibus. The route, which it was thought had reached the limit of its capacity, immediately began to improve its returns. The trolley 'bus became very popular, and attracted more passengers than had ever ridden on the tramcars. This was at first put down to "curiosity" or "joy riding," but the increase in the passengers carried, and the money earned, has been maintained. It has also been possible to increase the mileage, and this was done without increasing the number of cars in service.

The returns of traffic week by week since the inauguration of the system are placed side by side with the returns of the tramway system for the equivalent period of the previous year to show the great improvement which has taken place.

The revenue account for four months of the Nechells route is also reproduced.

The resultant cost of 12.648d. per car-mile compares with the operating costs of tramcars and omnibuses in Birmingham as follows:—

Motor omnibuses	15.407d.	(12 months).
Tramcars	14.824d.	,,
Trolley omnibuses	12.648d.	(4 months).

It may be said that these figures flatter, inasmuch as the trolley vehicles were all new and the full burden of repairs and maintenance had not been reached; still, it is maintained that the operating costs of trolley 'buses need not exceed the cost of tramway operation.

In conclusion, it may be said that each system has its own sphere of usefulness, and any system that fits in with traffic requirements, whether it be tramways, petrol motor omnibuses, or trolley omnibuses, will be adopted.

For dealing with large volumes of traffic, tramways still hold the field, and there are no signs at the present time of any other system being developed which is likely to supersede them. If the author were asked how he would employ petrol omnibuses and trolley omnibuses in conjunction with tramways, he would be inclined to suggest, although in every case local conditions would have to be the deciding factor, as follows:—

1. In anticipation of an extension of an existing tramway, where it was reasonably probable that tramways would be required at some future date, he would use the trolley omnibus. All that would have to be done would be to plant poles and fit up the overhead wires, which could be used afterwards for the tramways.

2. He would use the trolley omnibus in substitution for a single line of tramway where the traffics were light, or where it was not possible to double the track, particularly when faced with reconstruction. In other words, he would repeat the Nechells experiment. In this connection there are several of the smaller provincial undertakings in this country who are faced with entire reconstruction of their tracks who would be well advised to consider the question of abandoning their tramways and substituting trolley omnibuses.

3. On routes in suburban districts where some sort of transport was necessary and where there was no likelihood of tramways being required, he would certainly use the petrol 'bus.

4. He would use the petrol 'bus in running cross-country routes and in connecting up the outer termini of tramways. Motor omnibuses can be made to serve a most useful purpose in linking together the country ends of the tramways.

Discussion.

Mr. Baker, introducing the paper, said it had been written at the request of the President and Council, and was really only a brief narration of facts. Referring later to the financial results he said that the trolley 'bus route was the only one on which any increase in receipts had been made. Moreover, the trolley-'buses were running on a route where the fares had been reduced, as compared with the high fares on the tramways, so that had the fares been the ordinary ones the increase in receipts would have approximated to the increase in mileage. Everything had been charged against trolley 'bus operation, and in some respects more money had been charged against costs than the system really ought to have borne. The result of operation showed that a balance of £3,023 was carried to profit and loss account for the period mentioned.

Opening the discussion, Mr. J. B. Hamilton (General Manager, Leeds) said he was delighted to find that Mr. Baker's experiments with trolley 'buses had turned out so satisfactorily.

* The system was described in our issue of February 9th last (p. 220).

It was exceedingly useful to have people who had held out for such a long time, as the Birmingham people had done (they came and looked at Leeds many years before the war), adopting the same policy, and to find that one's own earlier views had been confirmed by them. Transport authorities must seriously consider all the various forms of transport. The improvement that had been made in trolley 'buses by the introduction of larger cars was making that form of traction quite possible in places where, with the old single-deck vehicle with a capacity of 30 passengers, it was previously impossible. In Leeds there had been for a year and a half trolley 'buses with a carrying capacity of 59 which were absolutely irreproachable and certain in operation. These vehicles compared very favourably in carrying capacity with many tramcars and, therefore, not merely for interurban or outside areas but in cities and towns, they were coming to a type of vehicle which in time might meet all the requirements in connection with the movement of passengers at the time of maximum demand, which demand hitherto it had only been possible to meet with tramways. He held the view that if the supply of electricity was in a convenient position to serve an area and it required something more than an intermittent service, in quite rural districts trolley 'buses could be operated at less cost than motor 'buses.

Mr. H. MOZLEY (General Manager, Burnley) asked whether a trolley 'bus system would be liable to rating and assessment, as were tramways, or whether it would be free from this as were motor 'buses.

Councillor G. R. DAVEY (Vice-Chairman, Ilford) said it was clear that in outside areas the trolley 'bus system could be used, but all tramway men would agree that there was nothing to beat tramways for busy areas.

Alderman W. GODBOLD, J.P. (Mayor of West Ham), asked whether Mr. Baker suggested that something should be contributed by the trolley 'buses to the maintenance of roads.

Mr. W. MURRAY (General Manager, Walthamstow) said that some 12 years ago his Council took up this question and it was a mere chance then that they did not succeed in scrapping the tramways and adopting the new system. The point was, however, that even in some of the small undertakings there were times of peak load when the tramcar was inadequate to meet the rush traffic. In Walthamstow he had to overload the cars sometimes to the extent of 100 per cent., and then failed to carry all the passengers, whilst during the remainder of the day the loading was extremely light. Therefore, the trolley 'bus would not be sufficient; but there was a danger, because of the average light loading, of people saying that trolley 'buses would be sufficient for all the needs, and overlooking the rush traffic. The argument that because Birmingham found it a good thing on one route, therefore it would be a good thing for all small undertakings, was a mistaken one.

Mr. H. P. STOKES (General Manager, Plymouth) contended that on the figures in the paper, it would have been cheaper to reconstruct the tramways on the Nechells route but what the trolley 'bus had done was to avoid the heavy road maintenance charges which tramways had to bear. The municipality itself, however, had still to bear these road maintenance charges, and whether this was the right way to get out of what had been felt for many years to be a very serious disadvantage was questionable. If trolley 'buses and petrol 'buses were made to bear their fair proportion of road maintenance charges, the trolley 'buses would show no advantage whatever, even on such a route as the Nechells route, as compared with tramways.

Alderman F. SMITH (Deputy-Chairman, Liverpool) said that although Mr. Baker said there was no upkeep of roads incurred by the tramways by using trolley 'buses, there was upkeep of the roads out of the city's pocket, and he hoped that tramway men would not seek to differentiate between the pockets of the tramways and the pockets of the city.

Mr. C. OWEN SILVERS (General Manager, Wolverhampton) said it seemed that on the Nechells route, Mr. Baker was taking approximately £10,000 per mile of route per annum. From the latest accounts of 37 undertakings no fewer than 24 were taking less than this amount on the average, and he thought most engineers responsible for passenger traffic, in the provinces, would not feel justified in relaying all their tramway tracks.

Alderman TURNEY (Vice-Chairman, Nottingham) thought the real crux of the matter lay in the fact that if the trolley 'bus system were universally adopted, the burden of maintaining the roads would fall upon another department and not upon the tramways. The adoption of the trolley 'bus would not play such havoc with the roads, and therefore even if some contribution were made towards the upkeep of the roads, it would not be nearly so much as in the case of tramways. Where there was single tramway track with cross-overs in a residential district, it would be infinitely preferable to have some means of transit such as that indicated and recommended by Mr. Baker, because it would lead to an appreciation rather than a depreciation of rateable value; the latter was the case where there were tramways.

Mr. R. BIRKETT (General Manager, Southend) said the fact that a 'bus company in Southend paid a dividend of 25 per cent. last year and doubled its capital investment, whilst this year the dividend was 30 per cent., had caused a great deal of opposition to the tramways and to the proposed trolley 'buses. The most serious objection to tramways was the question of noise. In Southend the 'buses run by the company were silent; they used single-deck cars with pneumatic tires. In Southend he had a Light Railway Order, and the police had no jurisdiction; he calculated that in Southend the profits were made by overcrowding and it would be unwise to prevent it. Under his Light Railway Order he could overcrowd to any extent, and he did. At rush times he overloaded to the extent of 100 per cent. With trolley 'buses one would be limited, and the question of spares became a very serious one, because there was the housing of spares to be thought of. In Southend half of the road was maintained at the expense of the tramways. Moreover, the tramway track was used by nearly every other vehicle, because the other traffic persisted in running on the centre of the road. Thus the good roads on which the 'buses were run by the company were maintained by the tramway undertaking. It was important to consider under what conditions it paid to run either tramcars or 'buses or trolley 'buses; he had prepared curves which showed the exact effect upon the cost of any alteration in the services. Similar curves could be prepared for the three systems, so that it could be seen when it would pay to put on a trolley 'bus service or petrol vehicles or tramcars.

Councillor J. H. WHITTAKER (Chairman, Todmorden) contended that any motor-'bus service could work at very much lower figures than those presented by the author. The motor 'bus was the most potent competitor with tramways to-day.

Alderman R. F. FLETCHER (Chairman, Wigan) complained that towns like Wigan, where the tramway service was half inside and half outside the borough, had to pay for the construction, reconstruction, and maintenance of the roads out side the borough.

Mr. C. BURGESS (General Manager, Walsall) said that in Birmingham the seating capacity of the trolley 'bus was nearly as great as that of the tramcars on many systems (51 passengers), and that being so he could not see why the trolley 'bus could not deal with the rush traffic in the same degree as the tramcar. The position appeared to be that the cost of operating the trolley 'bus was about the same as that of the tramcar. The initial cost of installation was apparently about half that of the tramways, or, rather, half the present cost of constructing track. He was sure that tramway committees up and down the country, when they went into this question of reconstructing tracks, would want to know why trolley 'buses would not do the job.

Mr. R. H. WILKINSON (General Manager, Bradford) said he experimented with one double-deck vehicle which weighed a little over seven tons; it started running in 1920 and he had never had any complaint about it though it had run 90,000 miles. A second vehicle which was put into service nearly two years ago, and was fitted with six wheels, four being in front and steerable, had run 40,000 miles. Its actual capacity was 66 passengers, but a certain portion of the vehicle had been deliberately shut off, and the seating capacity allowed was 59. There had been no trouble with either vehicle, and of the two the men preferred the six-wheel vehicle because it was easier to steer, although there was more weight on the steering wheels. He could confirm what Mr. Baker had said, viz., that the working expenses of the trolley 'bus would not exceed those of the tramcar. The use of trolley 'buses was growing steadily, and he could not see anything to hinder their being adopted quite largely in the near future. With regard to road maintenance, his two heavy vehicles had been running on a road made of tar macadam, and operating a ten-minute service; there had been no ill-effects to the road surface, and he was satisfied that the £70 a year tax on the vehicles would quite easily cover the damage to the roadway.

Mr. C. I. BAKER (General Manager, Ashton-under-Lyne) said his Council had decided to adopt trolley 'buses on certain sections of line very similar to that dealt with in Birmingham. The fact that an expenditure of £50,000, could be saved by not renewing the tramway tracks convinced his Council that the trolley 'bus was the cheaper system. Where the cost of old permanent way had been repaid, there was little doubt that the trolley 'bus was better than incurring the expenditure of reconstructing the tramway track.

Alderman T. CANBY (Chairman, Huddersfield) asked for information as to the safety of trolley 'buses in comparison with tramways.

Mr. J. BARNARD (General Manager, Bolton) pointed out that very little had been said in favour of the tramway; for a large volume of traffic the tramway still held the field. In Bolton, he was carrying passengers at a less price than any system in Great Britain, whether it were tramway, motor-'bus or trolley-'bus. He rather thought the figures in the paper had been made a little too rosy in favour of the trolley 'bus. For instance, it was mentioned that to reconstruct the Nechells route for tramways would have cost £30,000 a mile, but he suggested that this figure was 50 per cent. too high. Again, only £1,600 per car was allowed for the old cars; he believed Mr. Baker kept his cars in practically a new condition, and they would be worth much more than that. Therefore, there had to be given to the credit of the tramways a reduction in the cost of the reconstruction of track and a higher credit for the cars. In that event there would have been a profit on working tramways on the Nechells route of about the same amount as was shown on trolley 'buses. At present the trolley 'buses paid a yearly tax of £70, but no contribution to road maintenance; if they paid something for rating and road maintenance, in the same way as the tram-

ways did, the comparison would be still less favourable to the trolley 'bus.

Mr. Baker, replying to the discussion, agreed that the adoption of trolley 'buses depended upon local conditions. The steepest gradient on the Nechells route was 1 in 11, and there had never been any difficulty in negotiating this. Considerably higher speeds were obtainable than on the tramways, which could only do 7½ miles an hour on that route previously. The greater part of the £70 tax on the vehicles came back to the local authority for road maintenance, and he did not think there was much to complain of in that respect. The proportion of spares was no greater with the trolley 'bus than with the tramway; it was, however, certainly less than the spares required for the motor 'bus. It was impossible for him at present to believe that the trolley 'bus could deal with heavy or rush-hour traffic as adequately as tramways. The trolley 'bus carried 50 or 60 passengers, but tramcars were now used carrying 84 passengers in Manchester, and then probably overloaded, and with a service running at 30-second intervals it was impossible to imagine the number of trolley 'buses which would be required. The running of the vehicles so far did not seem to have had any serious effect upon the road surface. He admitted that the Assessment Committee had made a demand upon him for assessment upon the same terms as the tramways, *viz.*, as if a track had been laid, but he had been before that committee and had pointed out that it was fair that the line should be rated only on the poles and wires, and not upon a track which did not exist, and it was only upon the poles and wires that he would pay rates. The matter, however, had not yet been finally decided.

A hearty vote of thanks was accorded Mr. Baker on the motion of Alderman Smithson, of Leeds, seconded by Councillor T. White, of Liverpool, who referred to the question of road maintenance and the transfer of this burden from the tramways to the Highways Committee if trolley 'buses were largely adopted. He urged that the whole matter should be discussed, and pointed out that whereas it had been computed that the damage done to roads by ordinary motor and other vehicles amounted to something like £60,000,000 per annum, the amount obtained by taxes was only £10,000,000 or £11,000,000. He thought that some of those people who were advocating the scrapping of tramways would be very glad to have them again in a few years.

The paper on "Tramways as a Municipal Asset," by Alderman Clark (Rochdale) was then read, the discussion being adjourned until the following morning. An abstract of the paper was given in the Electrical Review of August 24th.

In the evening the Mayor of Portsmouth gave a dinner to the delegates, a company of about 500 sitting down in the Town Hall. The speeches were not of a serious order, the toasts being those of "The King," "The Imperial Forces," and "The Municipal Tramways Association."

Replying to the toast of "The Imperial Forces," Admiral Sir Sidney Sinclair (Commander-in-Chief at Portsmouth) appealed to tramway authorities throughout the country to do all they could to give employment to ex-service men. Both the Mayor and the President supported this appeal as members of the committee in Portsmouth dealing with this problem, and as an example of what Portsmouth was doing in this respect mentioned that the Portsmouth Tramways Department could easily dispense with 50 men on account of the winter service coming on, but it had decided to keep these men engaged.

CORRESPONDENCE.

Letters received by us **after 5 p.m. on Tuesday** *cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.*

"Preferential" Tariffs.

With reference to the article on Customs Tariffs in your issue of August 24th, may I remind you that when a would-be exporter has ascertained the *ad valorem* duties applicable to his products in the Dominions, he has only part of the information necessary to enable him to calculate the duty which his overseas customer will be required to pay.

Most of the Dominions take as the basis value for *ad valorem* duty the current domestic value in the country of origin (plus, in some cases, a certain percentage).

A schedule of duties alone is therefore not sufficient, but the exporter needs to know also the basis on which those duties will be calculated in each Dominion.

In addition, most of the Dominions have adopted anti-dumping legislation with which it is necessary for the exporter to be familiar before he can be sure of his figures.

The writer pointed out in articles on Inter-Imperial Trade, which you published in your issues of June 29th and July 6th, 1923, that, owing to the higher standard of living in this country, by taking the domestic value as the basis for ordinary duty and dumping duty, the Dominions are actually compelling importers of British goods to pay more in duties than they have to pay on similar foreign goods, even though they are sold in the Dominion at the same price, and in spite of the preferential tariff granted to British goods.

It would be well to give as much publicity as possible to these facts, because the Dominions are pressing us to grant them preference for their products in return for the preference which they have already granted to ours, and those who are not familiar with the application of the Dominion duties will not realise that in many cases the preference granted to British goods does not exist in actual practice.

W. G. Newberry.

Eltham, *August 27th*, 1923.

The Difficulty of Starting.

I have noticed in the Press for some time now that there was room for the technical man, but I fail to see it. I am now 24. At the age of 14 I started in the stores of a well-known electrical firm and stayed with it for over three years. After that I went in for kinema and theatre work as assistant electrician and worked my way up to electrician.

I am now studying for the A.M.I.E.E. examination, and have written to some of the big firms in the hope of getting a suitable position, but with no result. In no case have I mentioned salary, so it cannot be on that account.

I have tried for stores, sales, wireman, assistant shift engineer, &c., and have also advertised in the Review. I should be pleased to know if the trade does want a man who is anxious to get on, or does it want one who just does his job and leaves it at that and never does any study in his spare time?

Is it worth while spending money and time in trying to improve your knowledge? I may add that I am at present out of the trade, through no fault of my own, but am free to accept a position in about four or five weeks' time. Can you advise me in any way?

S. R. D.

August 12th, 1923.

[There are many highly-qualified men out of employment at this difficult time. We can only advise "S. R. D." to keep on trying—some day his perseverance will be rewarded.—Eds. Elec. Rev.]

Price Reductions?

I note in your last issue that Holmfirth has applied to the Electricity Commissioners for leave to continue the price of electricity at 9d. per unit, and I should like to know whether the County of London Company has made a similar application to continue the price at 8d. per unit.

Unfortunately, I live in the Wandsworth district, and have to pay this price while consumers living within 50 yards of my house get their electricity for 6d. a unit, not from a super-station, but from a very modest generating station of some 5,000 kW capacity.

I believe a further substantial reduction is anticipated at an early date, but I expect I shall still have to pay 8d. a unit for electricity supplied by a company which, I believe, has a total output of over ten times that of this undertaking.

Perhaps the County of London Co. could see fit to justify its extravagant scale of charges by a reply to the Press, as I have found it impossible to obtain an explanation by private correspondence.

T. S. Wallis.

Wimbledon, *August 27th*, 1923.

[Reductions in the charges for lighting were announced by the County of London Co. commencing with the quarter-days in September, 1922, and March, 1923. But inasmuch as these "reductions" were on percentages above the nominal charge of 5½d. per kWh for domestic lighting, and still leave the actual charge at the maximum authorised price of 8d., the ordinary domestic consumer derived no benefit from them. The company requires no sanction for charging 8d. per kWh, which is its statutory limit.—Eds. Elec. Rev.]

Qualifications of a Tramway Manager.—The conditions of appointment of the new manager for the Belfast Corporation tramways came under consideration at a special meeting of the Belfast Corporation. Councillor Alexander drew attention to the advertisement by the Corporation with reference to the appointment of a new manager, the wording of which meant no Belfast man need apply for the position. The advertisement stated that applicants must be not only general managers, but engineers, with extensive technical and administrative ability and have a wide experience of tramway work. These words meant that no Belfastman, no Ulsterman, and no Irishman need apply, because they could not find an Irishman in the British Isles with those qualifications. He proposed that the words "an engineer" be left out. Councillor Magowan seconded. Supporting the amendment, Councillor McAleavey said that they required a business man as manager. They had plenty of engineers to spare in the Corporation, to whom the manager could apply for the assistance he required. The amendment was adopted.

BUSINESS NOTES.

Bankruptcy Proceedings.—A. C. Alexandra, mechanical and electrical engineer, 10, Iddesleigh House, Caxton Street, S.W.1.—Receiving order made August 20th on creditor's petition. First meeting September 3rd; public examination December 19th; both at Carey Street, W.C.

W. H. Mickleth waite, electrician, 2, Coronation Grove, Oatlands, Harrogate. An application for discharge has been made and will be heard at the Law Courts, Clifford Street, York, on September 25th.

S. L. Bapty & N. Miles, wireless instrument manufacturers, Avenue Works, Avenue Road, Willesden, N.W.—Receiving order made August 21st on debtor's own petition. First meeting September 4th; public examination December 19th; both at Carey Street, W.C.

J. S. Elliott & Co., electrical engineers, 12, Broad Street, Oxford.—Receiving order made on creditor's petition.

J. B. Robertson, electrical engineer's manager, Dahiem, Whitbarrow Lane, Lymm, Cheshire.—First and final dividend of 2s. 7d. in the £, payable at the offices of the Official Receiver, 11, Dale Street, Liverpool.

H. S. Rogers, electrical engineer's sales manager, 21, Derby Street, Walsall. Trustee, Mr. S. W. Page, 30, Lichfield Street, Wolverhampton, released August 16th.

Frederick Wilde, carrying on business at 18 and 20, Vauxhall Road, Liverpool, as the "Liverpool Engineering Co.," electrical engineer.—Last day for receipt of proofs for dividend, September 10th. Trustee: Mr. L. Nicholas, 19, Castle Street, Liverpool.

C. F. M. Metcalf (C. F. Metcalf), electrical engineer, 8, Cow Green, Halifax.—Receiving order made August 23rd on debtor's own petition.

T. R. W. Wyness and G. W. Bale (Wyness & Bale), electrical engineers, 13, Commercial Street, Brighouse.—First and final dividend of 5s. 1½d. in the £, payable September 1st, at 1, Albion Street, Boar Lane, Leeds.

T. R. W. Wyness (separate estate).—First and final dividend of 10s. 9d. in the £, payable September 1st, at 1, Albion Street, Boar Lane, Leeds.

Company Liquidations.—The Corona Lamp Works, Ltd., 10, Ascham Street, Kentish Town, N.W.—Under the compulsory winding-up order made against this company in June, 1922, a statement of affairs has been lodged showing gross liabilities £110,655, of which £82,265 is unsecured, and no available assets. The total deficiency in the case of both creditors and shareholders is stated at £84,265. The creditors include:—

	£		£
Bell & Co.	876	Ogilvie, G. N.	14,163
Crystal Glass Co.	21	,, ...	3,621
Humphries Horham, Ltd. ...	21	,, ...	6,666
Hickley & Co.	10	,, ...	1,666
Livingstone Bros.	18	Westminster Bank	3,059
Stephenson & Son, Ltd. ...	21	Aeronautical Instrument Co.,	
Wilkinson, Ltd.	27	Ltd.	9,204
Hozell, J. J.	66	Smart, H. W.	1,591
Public Trustee	120	British Thomson-Houston Co.,	
Johnston & Co.	58	Ltd.	5,360
Metallic Electric Engineering		Vactite Wire Co. (1919), Ltd.	59
Co.	11	Sutherland & Partners... ...	4,180
		Postmaster-General	16

Associated Electric Traders, Ltd., 2, Percy Street, Tottenham Court Road, W.C.—The statement of affairs filed under the liquidation of this company shows liabilities £5,719, against assets valued at £1,542. The following are the principal unsecured creditors:—

	£		£
Anglo-Italian Commercial Agency	98	London Commercial Electric	
Boin-Moyerson & Co.	200	Stores, Ltd.	176
Fontein, S. G.	72	Shrimpton, G., & Sons	105
Galliers, H. G.	60	Sindicato Industries D'Art ...	162
Gilner, G.	116	A. M. Builard, Mrs.	60
Hall, J., & Co.	491	Stella Conduit Co., Ltd. ...	53
Kremeneroky, J.	107	Saper Lamp Co.	50
Albert Lee & Co., Ltd.	95	Cox Bank, Ltd.	513
		P. D. Russell	330

Rhodes Fittings Co., Ltd., electrical and artistic fittings manufacturers, 224, Upper Thames Street, E.C.4.—A meeting of the creditors in this matter was held on August 22nd, at the offices of the Chartered Institute of Secretaries, London Wall, E.C., when the liquidator, Mr. C. H. Whatley, A.C.I.S., of Charing Cross Chambers, Duke Street, Adelphi, W.C., took the chair. A statement of affairs was presented, which disclosed liabilities £685, all due to unsecured trade creditors. The assets comprised stock at cost £90, book debts £63, fixtures and fittings £7, cash at bank £2, making total assets of £162, or a deficiency of £523. It was reported that the company was incorporated on June 8th, 1921, with a share capital of £500 in 500 ordinary shares of £1 each, of which 170 shares had been issued. The object of the company was to carry on the business of manufacturers of all kinds of machinery, tool makers, iron and brass founders and general agents for electrical fittings, &c. Mr. Edward Gill and Mr. Sydney Rhodes were the first directors of the company, holding shares to the nominal value of £10, no remuneration being fixed. On June 13th, 1921, Mr. Gill was appointed secretary at a salary of £52 per annum, and he held this position until his retirement in October, 1922. Mr. Rhodes was appointed managing director on the same date at a salary of £7 per week, which sum was reduced on January 18th, 1922, to £2 per week, and 25 per cent. of the net profits. The accounts for the first year showed an expenditure of £1,754, while the sales, &c., were £1,373, or a loss for the year's working to April 30th, 1922, of £381. The failure of the company was attributed to insufficiency of working capital. The liquidator pointed out that the stock, which consisted mostly of wireless apparatus and glassware, had to be removed from the company's premises, and one of the creditors said he would house the stock free of charge until it could be disposed of to advantage. After a few questions had been asked and satisfactorily replied to by Mr. Whatley, it was decided to leave the matter in the hands of the liquidator. The following are creditors:—

	£		£
Davis, Cash & Co.	81	Robinson, L., & Co. ...	36
Saveker, T.	23	Re-Echo Wireless Co. ...	167
General Electric Co., Ltd.	43	Cressall Manufacturing Co.	17
Jeary Electrical Co., Ltd.	10	Atwood & Co.	17
Shrimpton & Sons	29	Bradford, Miss	27
Arcut & Co.	11	Ilett, G. C.	10
Polden & Co., Ltd. ...	218		

Scarborough Tramways Co.—A meeting of the creditors of this company was held at Scarborough on August 21rd. According to the *Yorkshire Herald*, the statement of affairs as regarded creditors showed gross liabilities of £22,207, of which £19,174 was owing to three fully secured creditors, and an estimated value of the securities of £19,276, showed an estimated surplus of £102 over the amount due to the three fully secured creditors; £2,809 was returned as owing to 66 unsecured creditors, and £224 to preferential creditors. The amount estimated by the officers of the company to rank for dividend was £2,809. The estimated total deficiency of assets to meet the liabilities of the company, subject to the cost of liquidation, was £2,707. As regarded contributories, the total deficiency was returned at £77,707 (7,500 ordinary shares of £10 per share, held by 10 shareholders, issued as fully paid up, representing £75,000). The Official Receiver (Mr. Donald S. Mackay) said that they had his observations before them, and the main item was that of £18,960 for the rolling stock of the company. That was the valuation by the officials. It was very difficult to say if it was correct. As far as one could judge from one's experience, if the company was disposed of as a going concern it might be realised. If it was sold piecemeal, perhaps none of them were prepared to say what was the value of that particular item. Since the winding-up order he had carried on the business with the assistance of Mr. H. W. Pulleyn, and the results had been satisfactory up to date. He was aware of the fact that he had been carrying on business just at the time when the company made its money. When the receiving order was made last April, cash in hand stood at £189. Last Saturday, after allowing for all outgoings, there was £3,174, so that the trading for the last three months resulted apparently in a profit of something like £3,000.

Mr. Herbert Walker Pulleyn was appointed liquidator.

Messrs. G. F. Holden, Jas. Edwin Twidell (Hull), and T. F. Brogden were appointed representatives of the creditors on the committee of inspection.

The contributories met subsequently to appoint two representatives.

Cesco, Ltd.—Particulars of claims to be sent to the liquidator, Mr. A. H. Smith, 3, Park Place, Cardiff, by September 12th.

The Stols Electrophone Co. (1914), Ltd.—Last day for receiving proofs for dividend September 10th. Liquidator: Mr. H. E. Burgess, Senior Official Receiver and Liquidator, 33, Carey Street, W.C.2.

Dissolution of Partnership.—G. H. Stevens & Co., electrical engineers and contractors, 108, Fenchurch Street, E.C.,—Messrs. G. H. Stevens and W. P. Fanghanel have dissolved partnership as from May 1st last, Mr. Fanghanel retiring from the firm.

Trade Announcements.—Mr. Ernest Whitby, 33, Newhall Street, Birmingham, has been appointed sole selling agent in Birmingham and district for Switchgear & Cowans, Ltd., Old Trafford, Manchester.

Messrs. W. T. Glover & Co., Ltd., Trafford Park, Manchester, have recently opened branch offices and stores at 14, Long Millgate, Manchester—telephone "City 6230/3"—where large stocks of their standard sizes and grades of v.i.r. wires, cables and flexible cords are held.

Messrs. Mawdsley's, Ltd., have appointed Mr. Alex. R. Munday, 41, Chichester Street, Belfast, as their agent for the whole of Ireland.

The Liverpool Electric Cable Co., Ltd., informs us that on September 1st, in conjunction with the London Electric Wire Co. and Smith's, Ltd., it is opening a Scottish branch at 51, Renfield Street, Glasgow, with Mr. J. K. Gellatly as manager. Stocks will be carried of the manufactures of both firms. Telephone: "Central 9002."

Catalogues and Lists.—The Hinchcliffe Green Manufacturing Co., Ltd., Airedale Works, Holbeck, Leeds.—An illustrated catalogue containing details, specifications, and prices of d.c. and a.c. motors.

The Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough.—An illustrated pamphlet (No. 101/0.1) describing in detail "Brush-Delas" air ejectors.

Messrs. H. W. Sullivan, Ltd., Winchester House, E.C.2.—An illustrated and priced booklet containing details of electric fires, heaters and small cookers, of many patterns.

The Cambridge and Paul Instrument Co., Ltd., 45, Grosvenor Place, S.W.1.—A mailing card advertising a combined catalogue and text-book dealing with high-frequency instruments.

Messrs. Dorman & Smith, Ltd., Ordsal Electrical Works, Salford, Manchester.—Catalogue No. 99 (232 pp.), a very comprehensive list of switch- and fuse-gear, industrial lighting fittings, &c. Fully illustrated and priced.

Messrs. Francis Morton & Co., Ltd., Hamilton Ironworks, Garston, Liverpool.—Two illustrated leaflets dealing with telegraph and transmission line poles of riveted steel.

Messrs. Veritys, Ltd., Plume and Victoria Works, Aston, Birmingham.—Publication No. 945, containing illustrations and prices of "Maxlume" lanterns and reflectors of all patterns, as well as brackets and other accessories.

The Rawlplug Co., Ltd., Gloucester House, Cromwell Road, S.W.7.—"Bigger Business," a little magazine dealing with "Rawlplugs" and other matters. Copies can be sent regularly to those interested.

Dugdill's Patents, Hazel Grove, Stockport.—A card bearing numerous illustrations of brackets, standards and ceiling fittings for lighting purposes.

The Wholesale Electrical Co. (1922), Ltd., 78, Charlotte Street, Fitzroy Square, W.1.—A pamphlet describing the "Pinnacle" quick-make and break rotary switch-fuse.

The New Italian Art Association, Ltd., 38, Newman Street, W.1.—Two illustrated booklets, giving prices of alabaster bowls, table standards, &c., for lighting purposes.

Messrs. Fleming, Birkby & Goodall, Ltd., Liversedge, Yorks.—A mailing card advertising "Elo" insulating composition.

The British Thomson-Houston Co., Ltd., Rugby.—Descriptive List No. 5,112-B, and Price Supplement No. 5,112-A, dealing with oil-immersed star-delta starting switches; and Price Supplement No. 2,143-A, containing prices of 25-cycle induction motors for pressures up to 550 V.

For Sale.—Wallasey Corporation Electricity Department has for disposal one 1,100-kVA turbo-alternator (3-phase), coupled to an auto-transformer, with condensing plant, and one 55-kVA single-phase alternator.

Sutton Coldfield Corporation Electricity Department invites offers for one balancing motor generator and boosters, consisting of four machines (G.E.C.) coupled together and mounted on two bedplates.

Colwyn Bay and Colwyn Urban District Council has for disposal two Babcock & Wilcox and one Sterling boilers, three steam generating sets, condensing set, parts of a switchboard, and sundry steam and exhaust connections. (See our advertisement pages to-day.)

Stoker Orders.—Amongst the more important recent sales effected by the Underfeed Stoker Co., Ltd., are the following:—Travelling grate stokers, Poplar (3), Stepney (3), Scottish Central Electric (4), St. Marylebone (6), Carlisle (2), Stoke-on-Trent (8), Swansea (4), Hull (2), Tunbridge Wells (2), Midland Electric Co. (3), Birmingham Corporation (6), Kumamoto Electric Light, Japan (8), other works (24). Underfeed stokers (31). An air-heater has been supplied to Hull Corporation and ash conveyors to St. Pancras and St. Marylebone Electricity Works.

Lead Report.—Messrs. James Forster & Co. report, under date August 25th: Closing prices yesterday were £24 10s. for both prompt and forward, against £24 at the end of last week. The statistics published by the Metal Exchange for the first six months of the year show a total of 91,813 tons "left for home absorption"—a monthly average of 15,302 tons, against 12,869 tons monthly in 1922, an increase of 20 per cent. We have made careful inquiries and are able to state that in neither the domestic (sheet and pipe) trade nor the electrical cable trade has there been any increase of consumption this year, and that, as a matter of fact, the contrary is the case. The recent strike has considerably depleted hidden stocks, the existence of which is disclosed in the above figures, but the end of the strike this week has released ample supplies which, in some cases, consumers unable to take up have had to re-sell or lend. In the meantime arrivals keep up.

E.D.A. Activities.—In view of the success which attended its late shop-lighting campaign in the autumn of last year, the British Electrical Development Association has decided to repeat this on a somewhat larger scale during the coming autumn. As one of the means of popularising the use of electric lighting, controlled by time switches, in shop windows after closing hours, the Association has prepared a series of advertisements which will be prominently displayed in retail trade journals. The advertisements are up to the E.D.A.'s usual standard of attractiveness, consisting of well-drawn illustrations accompanied by concise statements setting forth the advantages of "after-hours" lighting.

Copper and Lead Prices.—Messrs. F. Smith & Co. report, August 28th.—Copper (electrolytic): bars, £70, 15s. decrease; ditto ditto sheets, no change; ditto ditto wire rods, £80, 15s decrease; ditto ditto h.c. wire, 10d., 1-16d. decrease.

Messrs. James & Shakespeare report, August 29th:—Copper bars, sheet and rod, no change; English pig lead, £26, 10s. increase.

Trade Mark Applications.—The following are among the recent applications for British trade marks. Objections to any of the marks may be entered within one month from the dates mentioned. In the case of foreign applications the names and addresses of the British representatives are also given:—

Patrone. No. 436, 437,968. Class 8. Wireless telephonic apparatus. Walter G. Harrison and Edward A. Culff, trading in co-partnership at 2, Church Lane, Walthamstow, E.17. (August 15th.)

Bosch. No. 429,517. Class 8. Sparking plugs Robert Bosch Gesellschaft, 4, Militar Strasse, Stuttgart, Germany. (W. P. Thompson & Co., 12, Church Street, Liverpool). (August 15th.)

Philips. No. 424,535. Class 13. Electric lamps (ordinary). Naamlooze Vennootschap Philips Metaal Gloeilampenfabriek, Eindhoven, Holland. (Boult, Wade & Tennant, 122, Hatton Garden, London, E.C.) (August 15th.)

Oasis. No. 437,538. Class 13. Electric pocket lamps and torches. The General Chemical & Pharmaceutical Co., Ltd., 57-59, Church Road, Willesden, N.W.10. August 15th, 1923.

Long's long life lamps (lettering and design). No. 438,614. Class 13. Electric lamps (ordinary). Frank Long, 317, Charles Road, Small Heath, Birmingham.

Syntron. No. 438,474. Class 6. Electric hammers. The National Electric Manufacturing Co., Second Avenue, Pittsburgh, U.S.A. (Marks & Clerk, 57-8, Lincoln's Inn Fields, London, W.C.) (August 22nd.)

Towncrier (lettering and design). No. 437,745. Class 8. Wireless telephonic and telegraphic apparatus and instruments. Walter Harvey, trading as the Harvey Radio Co., 10-12, Pentonville Road, N.1. (August 22nd.)

Lissenacon. No. 438,504. Class 8. Coils and apparatus for use in wireless telephony and telegraphy. Lissen Co., Woodger Road, Goldhawk Road, Shepherd's Bush, W. (August 22nd.)

Lissenstat. No. 438,505. Class 8. Coils and apparatus for use in wireless telephony and telegraphy. Lissen Co., Woodger Road, Goldhawk Road, Shepherd's Bush, W. (August 22nd.)

Book Notices.—"Stories of Scientific Discovery." By D. B. Hammond. Pp. x+199; figs. 8. London: Cambridge University Press. Price 6s. net.—This work is of a class which we would gladly see widely developed; though scientific discovery is a pursuit of supreme interest and of vital importance to mankind, science generally is (mistakenly) regarded by the public with aversion—"too much like work," presumably. The lives of great men, however, are of fascinating interest, and biographical studies such as those contained in this book, which are welcomed by the reading public, afford a useful means of introducing, collaterally, correct views regarding science and of promoting an intelligent appreciation of its aims and triumphs. Amongst the subjects of this volume are Faraday and the Curies, both full of romance and associated with discoveries which have most profoundly influenced the lives of men. The text is admirably written and the work can be cordially commended.

"Shop Kinks." By R. Grimshaw. Pp. 417; figs. 261. London: Constable & Co., Ltd. Price 18s. net.—This work, now in its sixth edition, has been considerably extended. It consists of a collection of chatty notes on the workshop in every conceivable aspect, from the drawing office to the scrap-heap. Nothing seems to come amiss to the versatile author, who has been a most assiduous note-collector and appears to have had a wide and varied experience. Whilst the price seems high, there are many interesting and useful items in the book, which is provided with a good index.

"Science Abstracts," Vol. 26, Part 8 (No. 308). Sections A, Physics; and B, Electrical Engineering. London: E. and F. N. Spon, Ltd. Price 3s. per section.

"British Acetylene and Welding Handbook," prepared by a Committee of the British Acetylene and Welding Association. Pp. 340. London: Acetylene and Welding Journal. Price 7s. 6d. net.

Photographic Publicity.—In the July issue of *The Professional Photographer* (Kodak, Ltd., Kingsway, W.C.2), is an article upon the methods adopted by a well-known firm in the production of its catalogues. The latter are built up on the loose-leaf principle. Each leaf is printed with a faint background design, and upon this is hinged a card-base photograph which can be turned over to show the usual catalogue reading matter printed on the back. It is suggested that next to showing the advertised articles themselves, there is no better method of making their qualities known than by means of good photographs.

Foreign Plant Tenders.—Following upon the case of Leeds, whose difficulty with regard to the placing of an order for a 10,000-kW turbo-alternator and condensing plant, in view of the wide difference between British and foreign quotations, was mentioned in our last issue, the Bradford Corporation finds itself in a similar position. The tenders put in for the supply of a turbo-generator at a cost of about £40,000, show a difference as between British and Continental tenders of £10,000 in favour of the latter. As in the case of Leeds the matter has been referred to a small sub-committee for consideration and report.

Annual Outing.—The second annual outing of the staff of the Electrical and Mechanical Engineers' Departments, London, Midland and Scottish Railway Company (G. & S.W. Section), took place on August 25th to Tighnabruaich, Kyles of Bute. The party, mustering about a hundred, was accompanied by Mr. J. R. Johnstone, chief electrician, Carriage and Wagon Department, Northern Division; Mr. Geo. Thomson, electrical engineer (G. & S.W. Section); and Mr. Hugh Urquhart (inspector of machinery, G. & S.W. Section). Luncheon was served on the steamer after leaving Dunoon, and, after a most enjoyable sail through beautiful Scottish scenery, Tighnabruaich was reached at 1.20 p.m.; the party returned at 5.22 p.m., and arrived in Glasgow at nine p.m.

Private Arrangements.—W. H. Hall and J. E. Cashnella, trading as W. Hall & Co., electricians, 71, Beak Street, Regent Street, London, W.—The meeting of creditors reported in our last issue was resumed on August 23rd at the Chancery Lane Safe Deposit, London, W.C. A statement of affairs was presented by Mr. C. Latham, accountant and auditor, of 15, Eastcheap, E.C., which disclosed liabilities of £1,229, all of which were due to the trade. The assets consisted of: Cash in hand and at bank, £64; insurances paid in advance, £15; furniture, fittings, &c., £50; stock, £2,535; and book-debts, £277, expected to produce £191. Mr. Latham stated that the creditors were called together a week earlier, and the meeting was then adjourned so that he could prepare a statement showing the position at the present time. The statement he had prepared showed that the assets totalled £2,855, from which had to be deducted £54 for preferential claims, leaving net assets of £2,801, or a surplus of £1,572. The debtor, Hall, commenced trading as an electrical contractor in 1903, and towards the close of last year went into the wireless trade. At the beginning of the present year he was joined by Mr. Cashnella, who had previously been in his employ. During the first four months of the present year the sales totalled £11,724. About the end of April the business began to fall off, and during May and June the takings were only £2,383. In July the sales were £499. It had to be remembered that during the present season there was very little business doing in electric lighting apparatus. Some portion of the electrical stock was in poor condition, but the bulk was good and easily saleable. The electrical branch seemed to have been somewhat neglected since the wireless business was taken up. After discussing the position, it was decided to accept the debtors' offer of payment in full, by instalments, and secured by a deed of composition to Mr. Latham. A committee was also appointed consisting of the representatives of the Power Equipment Co., Ltd., Oldham & Son, Ltd., and A. H. Hunt, Ltd.

Haimes & Son, electricians, 96, Devizes Road, Salisbury.—The creditors interested herein were called together a few days ago at the offices of Mr. S. G. Best, accountant and auditor, Avon Chambers, Salisbury. The statement of affairs showed liabilities of £246, all due to unsecured creditors. The assets were estimated to realise £132, or a deficiency of £112. The assets consisted of: Stock, estimated to realise £35; cash at bank, £39; and book-debts, £59. It was stated that Mr. Haimes died after a long illness about 15 months ago, leaving a somewhat large number of unpaid accounts, and the widow had since been struggling on, trying to get things straight. Unfortunately, however, circumstances had arisen which made it impossible for the business to be continued at a profit. A resolution was passed in favour of the estate being wound up under the deed of assignment, with Mr. Best as trustee.

Osram Lamps in France.—Some 20,000 ordinary and founder shares in the Société Française de la Lampe Osram were sequestrated as German property during the war and were sold by auction in March, 1922. These shares have recently passed into the possession of M. Richard Heller, formerly deputy-manager of the company in question, who is credited with the intention of re-starting the lamp factory at Puteaux.

Imperial Preference and Protection.—In view of the forthcoming Imperial Economic Conference, the National Union of Manufacturers is issuing a circular-letter and questionnaire to its members on the subject of foreign competition. The letter states that at the Conference the question of maintaining and extending the system of Imperial Preference will form one of the most important topics for discussion and decision, and there is no doubt that the subject of protection of home industry will come up for consideration. It is claimed that an exhibition of British and foreign samples, with their prices, held at Millbank in March, 1921, undoubtedly helped to bring about the passing of the Safeguarding of Industries Act. The Administrative Committee of the Union is of opinion that it would be very desirable to organise a similar exhibition "with a view to showing the necessity of further safeguarding British industry." The exhibition would be open only to members of the Legislature and officials representing the Dominions.

In the questionnaire members are asked how foreign competition affects their business, and their views are sought concerning protection in the home markets and questions of Imperial Preference. Mr. Godfrey Cheesman, general secretary of the National Union of Manufacturers, 6, Holborn Viaduct, E.C., will supply copies of the questionnaire to industrial firms outside the Union if required.—*The Times.*

A Large Canadian Ford Contract.—The Ford Motor Co. of Canada, Ltd., has awarded the contract for the erection of a large power plant to the S.E. Dinsmore Co. The building will be of steel-reinforced concrete and brick construction and equipped with power machinery valued at $1,500,000.—*Reuter's Trade Service* (Ford, Ontario).

Prices in Germany.—As a result of resolutions recently adopted by the Central Union of the German Electrical Industry, electrical manufacturers have begun to arrange sale prices on a gold mark basis, founded upon the dollar rate of exchange in New York.

Australia's External Trade.—From figures supplied to the *Board of Trade Journal* by our Trade Commissioner at Melbourne, it is seen that the value of imports into Australia during the eleven months ended May 31st last was £121,090,95 as compared with £90,825,906 in the equivalent period ended May 31st, 1922. Of this total, electrical machinery and appliances accounted for £3,055,040, iron and steel (bar, rod, ingots, &c.), £1,424,992, and covered wire and cable, £1,118,61 The exports reached a total value of £111,171,588, as compared with £117,258,111, this figure including zinc concentrates to the value of £1,360,200.

British Empire Exhibition Notes.—Progress.—Sir James Stevenson, Bart., Chairman of the Board, in an interview recently reviewed the progress of the Exhibition since the new Board got to work. "The past three months," said Sir James Stevenson, "have been strenuous days, but have made a tremendous difference to the appearance of the grounds at Wembley. From the Stadium one can now visualise some indication of what is to be the greatest British Empire Exhibition ever planned. Most of the buildings are now under way, and every day sees some definite progress in one direction or another. It is hoped that the Palace of Engineering and the Palace of Industry, the two largest buildings in the Exhibition, will be completed within the next few weeks.

"Space allotment is proceeding as rapidly as possible. Practically all the space has now been applied for. Most of it could have been allotted long ago but we are trying to make the Exhibition as representative as possible, and we want to see that no important industry is overlooked. In the Engineering Section alone nearly 300 firms are represented, a figure which no previous exhibition has ever attained.

"The Wembley enterprise has nothing whatsoever to do with questions of economic policy. It is an exhibition first and last. Its main object of course, is to extend trade within the British Empire, but it is not the concern of the Board of the Exhibition to propound any policy by which that extension may be achieved. The Exhibition will show what the Empire can produce in raw materials and in finished production."

Referring to the World Power Conference which is to be held during the Exhibition, the *Daily Telegraph* says that in order to consider certain important matters arising in connection with the event, a preliminary conference of the various interested parties has just been held in London, the participants in which included Mr. J. B. Challies, Director of the Dominion Water Power Branch of the Department of the Interior at Ottawa, Canada, who has also been in conference with the authorities in Paris. Mr. Challies, who is chairman of the Canadian National Committee, said that the Dominion was particularly interested in the congress and its purpose, because it had already developed so much of its water-power resources and had become such a considerable market for hydro-electric machinery and equipment.

A Colliery at Wembley.—A full-sized colliery, complete with headgear, pit ponies, underground stables, washeries and all the most up-to-date paraphernalia of coal-mining, in actual operation, is to be one of the many sensations of the British Empire Exhibition. Coal mining, the mainspring of our national wealth and our premier industry, requires to be represented in some special manner consistent with its importance, and the sinking and construction of this working colliery has been the final decision. The idea originated with the Mining Association of Great Britain, the coal owners' organisation, which granted the money necessary for the purpose, estimated at £100,000.

One of the principal features of the mine will be an electric winding engine which will be able to lower into the workings 2,000 people an hour. Over the top of the shaft, which will be 18 ft. in diameter, will be erected a steel headgear 80 ft high.

Next to the winding-engine house will be a lamp room containing electric and oil lamps. Adjacent to this will be offices, bath-rooms for miners, a motor ambulance house, workshops and electrically-driven air compressors. An electrically-driven fan will be seen in operation, ventilating the labyrinth of underground tunnels that extends about a quarter of a mile.

After inspecting the surface plant, visitors will be lowered in a two-decked cage to the shaft bottom, and will step out into actual underground workings.

An electrically-driven pump, a haulage engine, electrical and compressed air coal-cutters, and conveyers will be seen in operation. After leaving the workings, visitors, having regained the surface, will pass into a large hall, where they will see the progress that has been made in the mining industry during the past fifty years.

The exhibit should prove one of the strongest attractions of the Exhibition.

Bauxite Deposits in Russia.—Large deposits of bauxite are reported to have been discovered in the province of Permsk as a result of explorations carried out under the leading of M. Tumanoff, and 160 tons are said to have already been produced. An application has now been made to the Supreme Council of National Economy for the allocation of funds to work the deposits.

The Economic Situation of Egypt.—In his report upon the economic and financial situation of Egypt (Stationery Office, 1s. 6d. net), Mr. E. Horman Mulock does not deal much with the electrical aspect. He mentions that engineering works capable of producing spare parts for machinery, pumps, and boilers have developed considerably since the war, while at Alexandria and Port Said there are several ship-building and repairing works. It is stated that industry and production should be assisted considerably by a combine, which, as a start, comprised the heads of 35 of the most important industrial concerns in Egypt, under the title of *Association des Industries en Egypte*. British, Belgian, French, and Italian industrial enterprises form the bulk of the founders, and include such varied interests as waterworks, clothing, spinning, sugar-refining, petroleum, tramways, cotton, and cold storage. The objects of the combine, which has Government approval, are to work together for the common good of the industries represented by it, to study the best means of developing them, and to protect them in case of need. The combined capital of the companies concerned is £E.8,000,000, and the annual subscription for the first four years is £E.2,000.

Cuban Information Available.—Mr. E. V. B. Brice, British Consul at Santiago de Cuba, who is now on a visit to the United Kingdom, will be pleased to interview firms interested in trade with Cuba, particularly Eastern Cuba, at the Department of Overseas Trade, from August 28th to September 8th, inclusive. These interviews will be given only by appointment, and applications should be addressed to the Comptroller-General, Department of Overseas Trade, 35, Old Queen Street, London, S.W.1, quoting reference 8622/F.L.

Patent Restoration.—The Comptroller-General of the Patent Office gives notice that an order dated August 21st has been made restoring Patent No. 148,380 of 1916, granted to Albert Van Tuyl Day, for an invention entitled "Improvements in or relating to electric high-frequency signalling."

New French Companies.—There has been formed at Paris (78, Rue Wattignies) the Société Anonyme Etablissements Bahrmann et Robin with a capital of 250,000 fr., for the moulding of insulating substances, fibre, ebonite, &c.

The Electro-Soudure Co. has been formed to work the Buckley & Saunders electric welding processes and others. Its offices are at 26, Rue Houtpoul, Paris, and its capital 200,000 fr., in 500-fr. shares, of which 100 are allotted to Messrs. Buckley, Saunders & Co., Ltd.; 50 to Messrs. Tourangin, Bull and Regnault; and 50 to the Société Gramme.

New Italian Companies.—There has been formed at Florence the Società Termoelettrica Italiana with a capital of 200,000 lire, raisable eventually to 8,200,000 lire.

The Società Anonima per Imprese Elettriche ed Industriali Petris e Rubbi is the style of a company established at Bologna with a capital of 50,000 lire, raisable to 500,000 lire.

With a capital of 100,000 lire, to be increased later, the Società Anonima di Energia Elettrica in Palazzuolo di Romagna has been constituted for the construction and extension of networks for the distribution of lighting and motive power.

With a capital of 100,000 lire has been formed at Milan the Società Idroelettrica dell'Isorno for the working of hydro-electric stations.

Under the style of Fabbrica Italiana Valvole Elettriche Rotative Brevetti Antinora Fiver has been embodied at Rome a company to work the Antinoro patents. The capital is 400,000 lire, raisable to 1,000,000 lire.

There has been embodied at Galliera Veneta the Esercizi Elettrici già Impresa Elettrica di Citadella, a company with a capital of 300,000 lire, raisable to 5,000,000 lire.

The Società Idroelettrica Rosetti has been formed at Milan with a capital of 150,000 lire, for the working of hydro-electric plant, power distribution, and the electrification of railways, tramways, &c.

There has been established at Turin the Società Idro-termo-elettrica Calabria S.I.C. for the construction and working of electric plant and the distribution of electricity. Of the capital of 350,000 lire, 75,000 and 25,000 lire respectively have been taken up by the Società Idroelettrica Piemonte and the Società Elettrica Savona.

The growing interest in the United States in Italian affairs is shown by the formation of The Italian Power Co., with a capital of $2,000,000. At the head of the concern is a group of American business men, whose programme embraces other new departures in the future.

Department of Overseas Trade Appointments.—The *Board of Trade Journal* states that Col. Harold Woods, O.B.E., has been appointed Commercial Secretary (Grade II) for Turkey in succession to Capt. C. H. Courthope Monroe, resigned.

The address of the Imperial Trade Correspondent at Bulawayo is now as follows: Mr. F. Fisher, P.O. Box No. 748, Bulawayo.

Japanese Contract for Belgium.—The Japanese Government has placed a contract with Belgian manufacturers for steel rails to the value of more than three-and-a-half million francs. It is stated that the Belgian electrical constructional industry is negotiating for the supply of the equipment needed for the exploitation of the hydraulic energy of certain Japanese rivers.—*Manchester Guardian Commercial.*

Foreign Concessions in Kovno.—The municipality of Kovno (Lithuania) recently decided to offer for competition, open to all nationalities, a contract for the construction and administration of waterworks and water supply, of canalisation, and of electric tramways in Kovno. Negotiations relating to these contracts proceeded for some time and two French and one German offers have already been submitted. The *Ost Express* learns that the president of a big Dutch-German concern of contractors has arrived at Kovno in order to negotiate regarding these concessions.—*Reuter's Trade Service* (Kovno).

Unemployment Returns.—The number of persons on August 13th recorded on the live registers of the employment exchanges in Great Britain as wholly unemployed was 1,211,900. This was 20,074 more than in the preceding week, but 273,978 less than the figure recorded on January 1st, 1923. The number working short time and drawing benefit for intervals of unemployment was 63,500 on August 13th, as compared with 64,923 on August 6th, and 56,261 on January 1st, 1923.

While decisions have yet to be made by the Government on matters of policy which may meet in a really bold way the expansion of unemployment which is expected with the approach of winter, small contributions to the limited list of productive schemes to deal with a serious situation continue to come from the State departments. The Post Office has now brought to definite form plans for laying hundreds of miles of ducts for underground telephone cables. The work is to be completed by March, 1924, and will give employment to some thousands of men.—*The Times.*

The Minister of Health, in reply to an appeal by the Barrow Board of Guardians to provide work during the coming winter to relieve the acute unemployment in the town, states that grants to be made by the Government are to be in aid of revenue-producing works. By this means it is hoped to secure the placing of substantial orders in towns in which heavy engineering is the principal ordinary employment, and that Barrow may benefit from these schemes.

The letter also states, says *The Times*, that the Government has given the Admiralty authority to anticipate future needs to the extent of £500,000, the bulk of which will be expended in Barrow and similar towns. The Government also hopes that railway companies will proceed as early as possible with works for electrification and development, which will be of great assistance to the engineering trades.

Engineers' Wages.—The *Daily Herald* reports that an endeavour is to be made by the Federation of Engineering and Shipbuilding Trades to persuade engineering employers to stabilise the remaining war bonus of 10s. per week now being paid to engineers.

The Trade of Tanganyika Territory.—The Trade Commissioner at Nairobi has forwarded to the Department of Overseas Trade an advance copy of the report of the Comptroller of Customs at Dar-es-Salaam upon the trade of Tanganyika Territory during 1922. This may be consulted by interested United Kingdom firms at the Department, 35, Old Queen Street, S.W.1.

Threatened London Municipal Strike.—A serious position has been created by the refusal of the Industrial Council to accede to the application of the employés of London municipalities for better conditions and the abolition of the existing sliding-scale agreement. It is reported that a series of fifteen meetings will be held in various parts of the county under the auspices of the National Federation of General Workers with a view to trade union action being taken by all employés of Metropolitan Borough Councils.

LIGHTING AND POWER NOTES.

Australia. — Victoria.—Mr. Macpherson, the Victorian Treasurer, is introducing a Bill to enable the Government to borrow £5,000,000 for water, railway, and electricity works.—*Reuter* (Melbourne).

Banchory (N.B.).—Proposed Electricity Scheme.—At the last monthly meeting of the Town Council, a report was submitted dealing with a scheme for supplying electricity in the town. It stated that the cost of a scheme employing underground transmission would be £11,060; overhead distribution would reduce this by £200. The Council decided to take a canvass of ratepayers before proceeding with a scheme.

Billingham (Durham).—Special Order.—The Special Order granted in favour of the Cleveland and Durham County Electric Power Co. has been submitted by the Electricity Commissioners to the Minister of Transport for confirmation.

Blean (Kent).—OBJECTION TO CHARGES.—The Rural Council has decided to object to the application of the Whitstable Electric Co., Ltd., for an order fixing the maximum prices to consumers, which includes minimum charges for the summer and winter quarters, on the ground that such charges are unfair to the consumers.

Burnley.—YEAR'S WORKING.—The borough electrical engineer (Mr. J. E. Starkie) reports that the income of the electricity undertaking for the year ended March 31st last was £90,970, as compared with £88,495 in the previous year. Against this was charged a working expenditure of £45,628, as against £70,170, leaving a gross surplus of £45,342 (£18,325). Although the capital charges were higher, the net profit was increased from £916 to £21,800. The capital account shows that £33,522 was expended during the year; the bulk of this (£25,417) was spent upon machinery for the Aqueduct Street station. The number of kWh sold increased from 7,423,557 to 7,809,997, the maximum load from 3,418 to 3,788 kW, and the plant capacity from 5,000 to 8,000 kW. The charges for electricity were slightly reduced during the year, and the engineer recommends a more favourable charge for power in order to secure the larger consumers.

RELIEF OF EMPLOYMENT.—The Electricity Committee, on August 24th, gave consideration to important electricity schemes which will probably involve a capital expenditure of over £60,000. An offer was received from the Unemployment Grants Committee to pay, for a period of fifteen years, 50 per cent. of the interest on any loans which might be raised for the purpose of providing capital for expenditure on revenue-producing works. It was decided to approach the Accrington Corporation with the object of putting speedily in hand the provision of an electricity main between the two boroughs, which will enable either authority to supply the other in case of necessity. The Committee also decided to recommend the Burnley Town Council to apply to the Unemployment Grants Committee for an extension of this authority's offer of a grant towards a scheme for the provision of an electricity main in the Rosegrove district.

Bury.—WATER FROM THE IRWELL.—The Ministry of Transport gives notice that upon representations made by the Electricity Commissioners it proposes to make an Order giving the Corporation powers to abstract water from the river Irwell for purposes of the electricity undertaking.

Canada.—UTILISATION OF THE ST. LAWRENCE.—The Ottawa correspondent of the *Manchester Guardian Commercial* states that Colonel Hugh Cooper, an American engineer who represents the Frontier Corporation, a company controlled by a large group of American industries, has submitted to the Federal Government a very comprehensive scheme for the development of the extensive water powers of the River St. Lawrence between Montreal and Lake Ontario. The scheme has many attractive features, and a tax on the large volume of power which the promoters expect to export to American industries south of the boundary would yield the Federal Treasury a very substantial annual revenue. But there is a difficult complication of Federal and provincial rights, and Sir Adam Beck, the chairman of the Ontario Hydro-Electric Power Commission, is insisting that all water power in which Ontario has any interest must be reserved for development under public ownership. The King Government will have to make up its mind and evolve a policy upon this important question, for through its absence another important project to utilise the Carillon Falls on the Ottawa River is being held up.

QUEBEC.—The Southern Canada Power Co. has awarded a contract for the development of 30,000 h.p. at Hemmings Falls, on the Saint Francis River, near Drummondville, to the Foundation Co. of Canada, Ltd., Montreal.—*Reuter's Trade Service* (Sherbrook, Que.)

Continental.—BELGIUM.—The scheme for the electrification of the province of Antwerp is being actively forwarded by the Conseil Provincial. There are some 90 communes unprovided with electricity either for lighting or power purposes. The question is mainly one of finance, and the alternatives are: The establishment by the communes of local networks, or the construction, at the cost of the province, of a high-pressure network radiating throughout the province. The cost of the latter alternative is estimated at about 10,000,000 fr., and is that which is favoured by the provincial authorities. Other provinces are also busy with similar schemes. In Brabant a commission is investigating a general scheme, but an alternative is amalgamation with the municipal establishment at Brussels. In Limburg a network is being carried out at the cost of the province, energy being obtained from coal-fields stations in the Caurpine district. In Luxembourg, a distributing company has received an advance of 1,500,000 fr., and is building a high-pressure line drawing its supplies of current from Halanzy and the East of France. In the province of Liége electrification by the province through the communes is preferred, private companies' offers being refused. In East Flanders and Namur capital is advanced to the communes by the province. In Hainaut the Provincial Deputation simply contents itself with limiting the duration of new concessions, reserving the study of the question till a future date.

NORWAY-DENMARK.—The General Export Association of Sweden states that at the Engineering Congress at Gothenburg the subject of transmitting the electricity needed in Denmark from Norway was thoroughly discussed. The estimated maximum requirement of electrical energy in Denmark ten years hence is placed at about 160,000 kW, with a minimum of 63,000 kW. The present plan, however, calculates for a consumption of only 42,000 kW supplied to the five principal towns of Denmark. The committee proposes four transmission schemes, as follows: (1) High-pressure direct current 12 x 110,000 volts to Aarhus and Copenhagen, where it would be converted to 50,000-V alternating current. Overhead conductors in Norway and Denmark; sea cables under the Skager-Rack and the Belts of 130 and 60 km. length respectively. (2) High-pressure direct-current 2 x 110,000 overland from Norway by way of Trollhättan and Hälsingborg in Sweden. This would require only comparatively short sea cables under the Sound and the Belts. (3) Three-phase current at 132,000 V overland across Sweden, transformed at Hälsingborg in Sweden to 50,000 V, thence by sea cable under the Sound. (4) Similar to the foregoing but with no stepping-down at Hälsingborg, conducted across the Sound at the narrowest place by aerial cables.

There is no appreciable difference in cost between the different schemes. For 42,000 kW it would be from 50 to 60 million Danish kroner. The annual cost per kW, according to this estimate, would be between 225 and 250 Danish kroner for 50,000-V, three-phase current. With an increase in consumption to about 53,000 kW, the price would be reduced to 200/235 Danish kr., and at 100,000 kW, to 180/210 kr. per kW.

As a résumé of the position it may be said that, as it has proved uneconomical up to the present to transmit power from Norway to Denmark, the solution will probably be found in the linking up of the Norwegian with the Swedish power circuits. Sweden already supplies electricity to Denmark by means of sea cables under the Sound.—*Reuter's Trade Service* (Stockholm).

NORWAY.—According to information furnished by the Norwegian State Administration of Water Power and Electricity, the total water power available in Norway represents 12,289,000 turbine h.p., of which the State owns 2,155,000 h.p. The existing hydro-electric works have plant of 1,800,000 h.p. installed, or 37 per cent. more than the power available at low water. As to the method of disposal of the electrical energy, it is mentioned that 42.1 per cent. is absorbed by the electrical manufacturing and electro-metallurgical branches, 12.1 per cent. by the timber and wood industry, and 38.2 per cent. by the general electricity supply branch.

LATVIA.—It is reported from Riga that the preparatory works in connection with the proposed erection of a hydro-electric power station at the Duna Falls near Dahlen are expected to be completed by the end of this year. A committee of experts under the direction of Prof. Reichelt, of Berlin, will then meet to settle the details of the scheme. It is calculated that it will be possible to obtain 40,000 h.p. at Dahlen and a sum equal to 30,000,000 gold fr. will be needed for the erection of the station. The allocation of the contracts will be determined by the Latvian Diet.

Clitheroe.—APPLICATION FOR ORDER.—The Council has decided to make application to the Electricity Commissioners for a Special Order for the provision of electricity for the town.

Clyde Valley.—NEW MAIN CABLE.—A cable is being laid by the Clyde Valley Electric Co. from the Blantyre Road through the Bothwell Castle policies to the Clyde. It is stated to be the intention of the company to tunnel the Clyde and thereby make connection to the south side, thence to Newton and Cambuslang.

East Ham.—YEAR'S WORKING.—The accounts of the electricity undertaking (engineer: Mr. W. C. Ullman) for the year ended March 31st, 1923, show a total income of £79,210, comparing with £81,006 in 1921-22. The working expenditure amounted to £46,280, as against £54,355, leaving a gross surplus of £32,930 (£26,651). As the capital charges remained at about the same level the net profit increased from £14,370 to £20,547. The capital account records an expenditure of £18,544, the largest single item being £5,652 for the supply and fixing of a converter.

The amount of energy sold increased from 4,837,662 to 5,385,224 kWh. The maximum load rose from 2,653 to 2,901 kW, while the plant capacity was increased from 2,925 to 4,425 kW.

Glasgow.—TWO-PART TARIFF.—The Electricity Committee, after considering the question of extending the two-part system of charging for energy used for domestic purposes to houses other than those occupied by the tenants of the Housing and Town Improvement Committee, to which the method of charging already applies, recommends that the two-part system be extended to the larger houses, on the basis of a fixed charge per annum, calculated according to rental of the consumer's premises, as fixed by the engineer and manager, plus a running charge of ¼d. per kWh for current consumed.

GAS-FIRED BOILER.—The Committee on Gas Supply is to be informed that the Electricity Department is now prepared to consider the gas firing of boilers at Dalmarnock power station, and to take from the Committee a supply of gas for that purpose.

PURCHASE OF COOKERS.—The Committee has authorised the manager to purchase an additional 200 electric cookers.

(*Continued on page* 325.)

STEEL WORKS ELECTRIFICATION.

The Consett Iron Co.'s Mills.

One of the most important examples of steel works reconstruction to be carried out in this country for many years is now being undertaken by the Consett Iron Co., which is modernising its steel works and plate mills. The work on the coke ovens and steel furnaces is well advanced, and the orders have now been placed for the new mill buildings, rolling mills, and electrical driving gear.

This reconstruction involves four entirely new mills, consisting of a 40-in. slabbing mill, a 42-in. plate mill, a 32-in. light plate mill, and a chequer plate mill. As was to be anticipated, the whole of the plant will be electrically driven, and as the slabbing and plate mills are to be of the two-high reversing type, the drives will be on the Ilgner system.

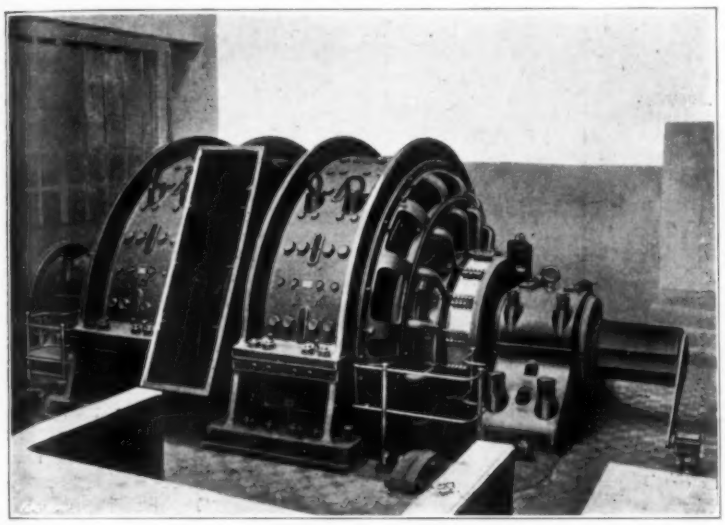

Fig. 1.—Typical Mill Motor.

The main reversing motors to be coupled direct to the mill will be duplicates, and will each consist of a double-armature motor designed for a maximum output of 14,000 h.p. between any speed of plus or minus 50 to 100 r.p.m.; a typical view of the mill motors is shown in fig. 1.

The flywheel Ilgner sets which will supply the mill motors will again be duplicates, and will each consist of a 2,500-h.p. three-phase induction motor coupled to two variable-voltage generators and a built-up steel flywheel, 48 tons in weight and 11 ft. 3 in. in diameter; the synchronous speed of the sets will be 600 r.p.m.

Under normal working conditions it is proposed to mechanically couple the two sets together, end to end, so that full use of the equalising effect of the two flywheels will be rendered available for steadying the load demanded from the station. Fig. 2 shows a typical fly-wheel set in which the arrangement of the machines is clearly shown.

By introducing the flywheel between the two variable-voltage generators, the power transmitted from the flywheel passes in two directions, thus avoiding excessively heavy shafts. The length of the set is reduced to a minimum by the avoidance of any flexible couplings, the whole set being carried by five bearings.

The light plate mill is to be of the three-high type, and will be driven by a continuously running induction motor with a normal output of 2,500 h.p. at 240 r.p.m. A flywheel, approximately 35 tons in weight and 15 ft. in diameter, will be coupled between the motor and the pinion housing, the latter acting, in addition, as a reduction gear to give a suitable speed to the mill.

The chequer mill will consist of a single two-high stand of rolls, and will be driven by a three-phase induction motor of 750 h.p. running at 240 r.p.m., a flywheel, 20 tons in weight and 8 ft. 6 in. in diameter, being interposed between the motor and the gearing. The type of induction motor for the light plate mill and chequer mill is shown in fig. 3 on page 322.

The new mills will be of Messrs. Davy Bros.' manufacture, whilst the electrical plant will be supplied by the English Electric Co., Ltd., and the two reversing drives now to be supplied will make the sets of reversing mill equipment built by this firm 15 in number. To provide the necessary power to drive the mills, the Consett Co. has on order two 3,000-kW turbo-generator sets, of which the turbines and condensers will be built by Messrs. Belliss & Morcom, Ltd., and the alternators and condensing plant motors will be of the English Electric Co.'s manufacture. Electricity will be generated at 3,300 volts, 40 cycles, 3-phase, the periodicity being chosen so that additional power can be drawn from the mains of the Newcastle Electric Supply Co. and the County of Durham Electric Power Supply Co., Ltd., when desired, or conversely any surplus power can be delivered into the power companies' mains, an arrangement which is mutually beneficial. The Consett Iron Co. has been a well-known manufacturer of steel plates for many years, and this new plant will put it in an exceptional position to meet the demand for such products under modern manufacturing conditions.

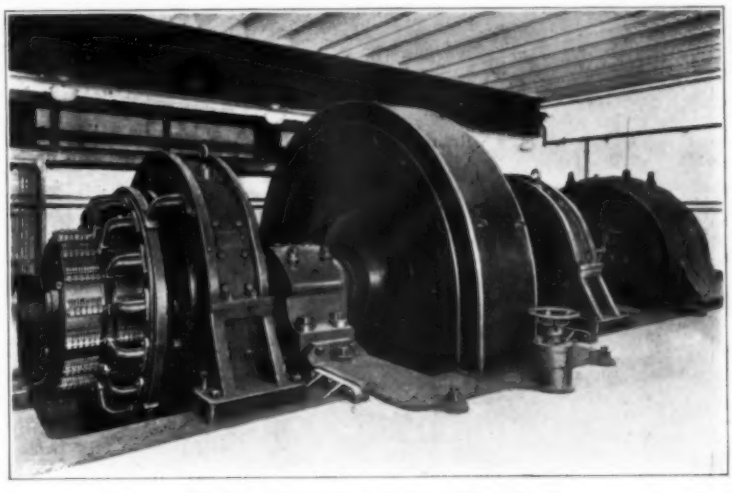

Fig. 2.—Flywheel Motor-generator Set.

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MESSRS. LYONS'S GREENFORD FACTORY.

An Interesting Visit.

An interesting and instructive Saturday afternoon was recently devoted by members and friends of the National Association of Supervising Electricians to a tour of inspection of the Greenford, Middlesex, works of Messrs. J Lyons & Co., Ltd., the well-known caterers and confectioners. With the boiler plant, heating equipment, pumps, compressors, and such-like details of mechanical interest for which Mr. S. Joliffe Butler, the company's chief engineer, has been responsible, we are not at the moment concerned, our object being to generally outline the 3-phase electrical installation of this modern food factory, the equipment of which has been carried out in Messrs. J. Lyons's usual thorough manner.

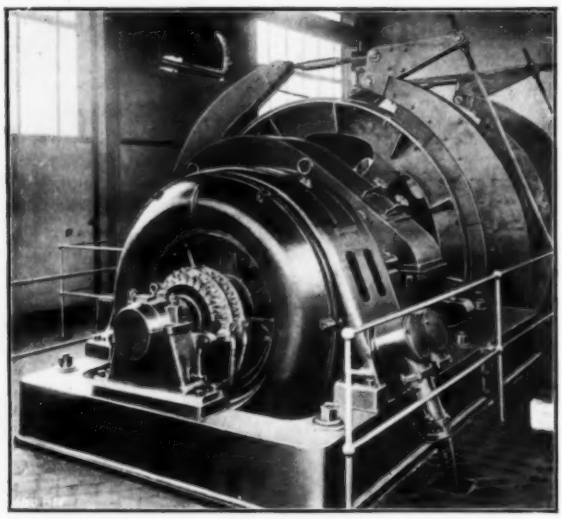

Fig. 3.—Typical Induction Motor for Light Plate and Chequer Plate Mills, Consett Co. (see page 321)

The conclusion of the tour leaves the visitor with the impression of a carefully-planned job well done; evidence of the appreciation of sound materials and good workmanship is not lacking, a policy that is fully justified by the reliability which is thereby afforded. To the uninitiated the dimensions of this new undertaking are surprising; nevertheless extensions are proceeding, and the factory will in all probability grow at a rapid rate.

Three-phase, 50-cycle electrical energy is delivered by means of a feeder teed at the Ironbridge sub-station to the 20,000-volt trunk main that connects the generating stations of the Uxbridge and District Electric Supply Co., Ltd., at Uxbridge, and of the Metropolitan Electric Supply Co. at Willesden. The 0.2 sq. in. round, three-core, steel-wire-armoured feeder, supplied by Callender's Cable and Construction Co., Ltd., terminates in a trifurcating box in the factory sub-station at Greenford, which was built by Messrs. Lyons to house three sets of transformers on the lower floor with the necessary switchgear above. At present, however, only one bank of transformers and one e.h.p. switch are installed, although a second set will shortly be needed.

The bank of three single-phase transformers has a capacity of 1,250 kVA, the connections being in delta on the primary 20,000-volt side and in star on the secondary 400-volt side; the transformers were supplied by the British Electric Transformer Co., Ltd., and are of the oil-immersed self-cooled type. In the e.h.p. switch-room stonework cubicles have been provided for switches that will be needed in the future; the existing Metropolitan-Vickers switch has a capacity of 100 amperes at 20,000 volts, the ratio of the current transformers being 40 to 5, and suitable instruments are installed for quickly ascertaining the kVA input.

From the l.p. terminals of the transformers tinned copper conductors pass to the adjoining l.p. switchroom, which contains the two switchboards illustrated in figs. 2 and 3. In order to be able to disconnect the whole of the gear in the l.p. switchroom from the transformers, a Ferguson, Pailin oil switch has been installed, on the leads from which current transformers are provided to actuate duplicate Aron-Merz integrating watt-

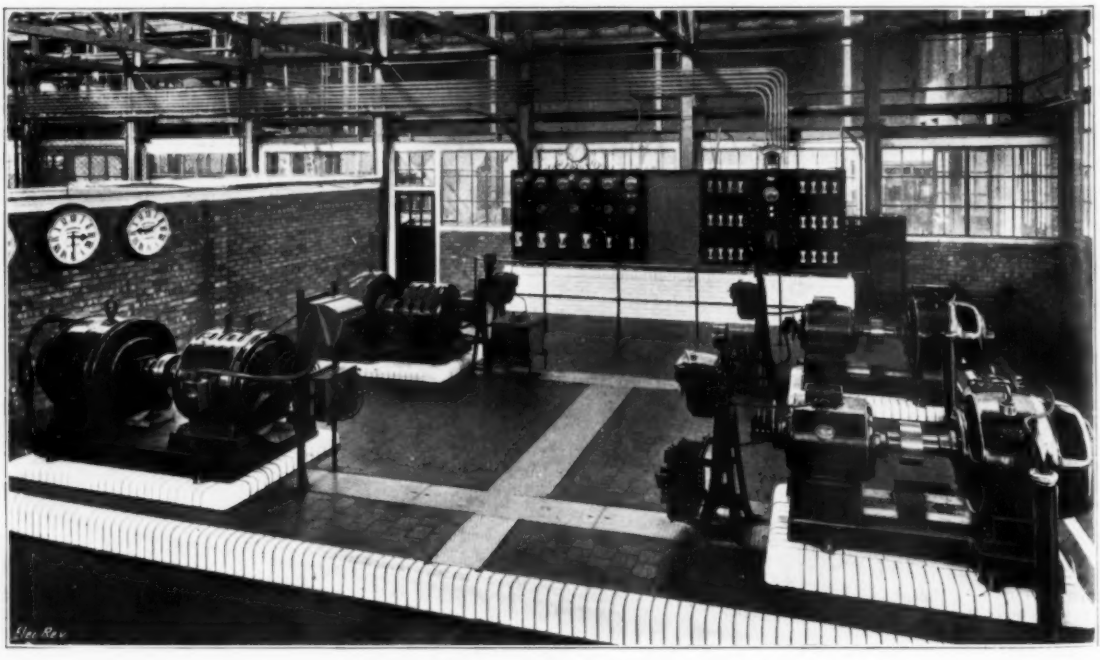

Fig. 1.—Converting Sub-station at Greenford.

meters with which are incorporated maximum-demand indicators. The meters constitute checks upon each other, one being the property of the Uxbridge Co. and the other of Messrs. Lyons; they are capable of dealing with 4,000 amperes in each of the line conductors and, being connected to the transformer star point, they register correctly on unbalanced loads.

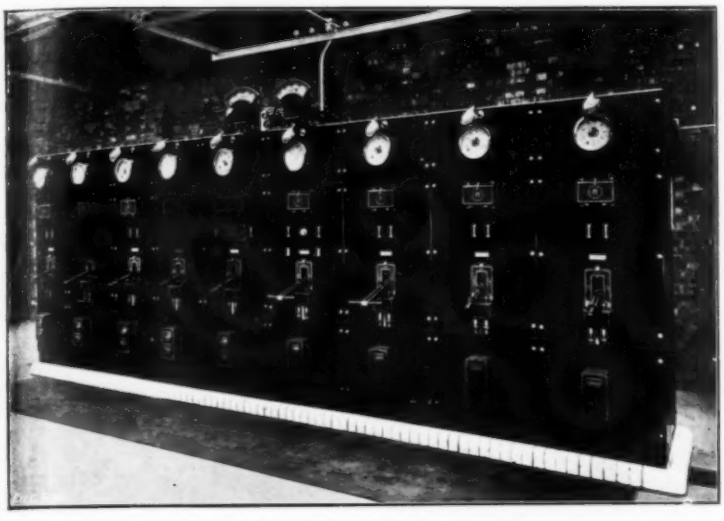

Fig. 2.—Main "Heavy Power" Switchboard.

Incidentally, the neutral conductor of the lighting system is also connected to the star point of the transformers, besides being earthed through three special cones outside the sub-station; all metal frames, armouring, conduit, and such-like parts, in addition to the hydrant pipes in various parts of the factory, are earthed by the same means. The heating of this switch-room proved to be a somewhat difficult problem on account of the manifestation of condensation troubles. They were, however, eventually overcome by the provision along the back of each switchboard of a row of ordinary electric radiator lamps, there being one lamp per panel. The heat generated by the lamps was found to be sufficient to maintain the temperature of the room constant.

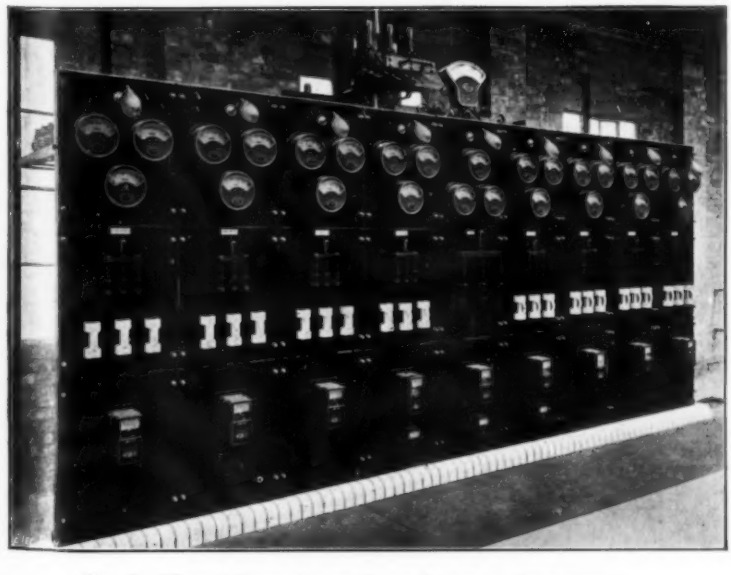

Fig. 3.—Main "Small Power" and Lighting Switchboard.

Through the above-mentioned Ferguson, Pailin main switch, the busbars of the "heavy power" switchboard shown in fig. 2 are fed; this consists of nine enamelled slate panels, one being a spare, and was erected by Messrs. Lyons's electrical staff, although it was made by the General Electric Co., Ltd. Each panel is fitted with an indicating kW meter and an integrating Aron meter; the outgoing oil-switch-controlled feeders are of 500-volt grade and were supplied by the Pirelli-General Cable Works, Ltd., being 3-core, sector-shaped, paper-insulated, lead-covered, double steel-armoured, laid direct in the ground and covered with sand boards.

From the cable supplying the above-described board, the "small-power" and lighting switchboard shown in fig. 3 is teed off, a main air-break overload-type switch being interposed between the two boards.

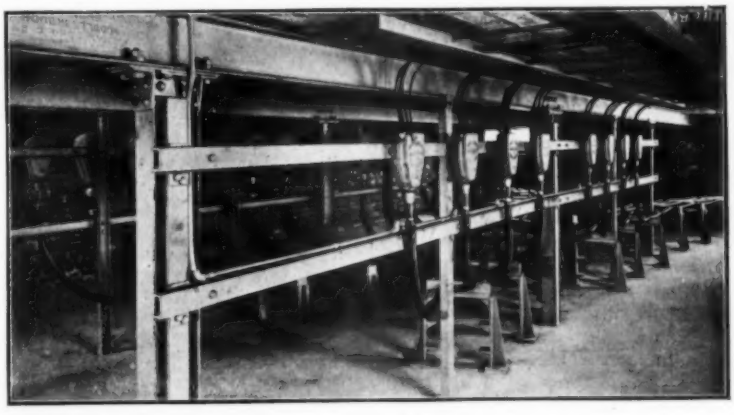

Fig. 4.—Cable Run under Main Switchboard.

This board was made by Messrs. J. Lyons & Co., Ltd., and consists of 9 panels, one of which is a totalising panel having a 3-pole knife switch and an ammeter on each phase. Electricity is distributed from this board on the 3-phase, 4-wire system, with a solid neutral throughout, and in order that any out-of-balance current may be corrected, each panel is provided with an ammeter on each phase, in addition to three porcelain-clad fuses and an integrating Chamberlain & Hookham watt meter. The cables running from this board are also of Pirelli-General make, but are of the four-core, sector-shaped type, double steel-armoured and laid direct in the ground. From fig. 4 the particularly neat arrangement of the cables from the trifurcating boxes under both the switchboards will be seen; they feed subsidiary switch-rooms in the various blocks of factory buildings.

These subsidiary switchrooms contain, besides the gear for the d.c. and emergency lighting services, a main oil switch on the incoming a.c. feeder, porcelain fuses through which the various motors in the buildings are fed,

and a wattmeter to act as a check on the respective meters on the main distribution board. In one case also a maximum demand indicator has been provided in the

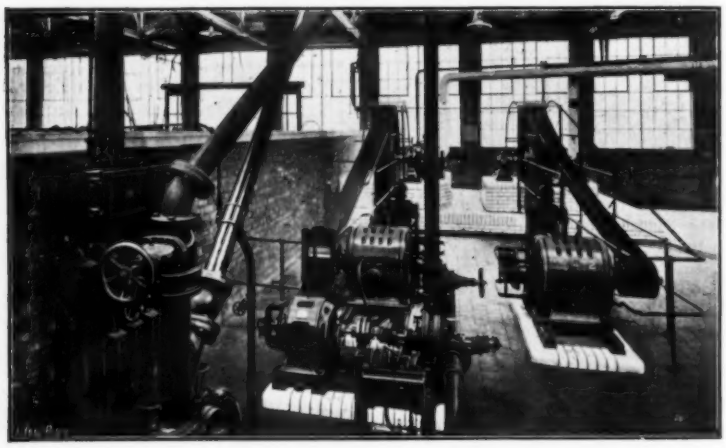

Fig. 5.—Motor-driven CO_2 Compressors.

form of a Metropolitan-Vickers integrating wattmeter operating in conjunction with a Venner time switch.

From the subsidiary switchrooms the wiring is encased in heavy-gauge enamelled steel tubes of a minimum diameter of ¾ in.; the conduit is run on the surface of the walls, has screwed joints, and easy bends, the wire being looped in, and no jointing was allowed where it could be avoided; 2,500-megohm grade cable has been used exclusively, the various sizes being calculated on the basis of 800 A per sq. in.

The lighting circuits are run through ironclad switches and fuses in the subsidiary switchrooms to sub-distribution boards located, as a rule, in the corridors of the buildings. These boards were built up very neatly by Messrs. J. Lyons's electrical staff with double-pole fuses on each phase, the lamps being arranged so far as has been possible alternately on different phases; the neutral connection is made solid up to the sub-distributing boards. Altogether there are approximately 1,400 lamps in the factory, including 90 police lights that are supplied from a battery of accumulators.

Direct current is required for certain special uses in the works, and is derived from the five motor-generators illustrated in fig. 1; two d.c. pressures are employed, namely, 110 and 400 volts, the latter being intended principally for the hoists and transporters. There are three 110-volt sets; the first is a 50-kW E.C.C. machine having a wound-rotor induction motor, E.C.C. starter, and Ellison main switch coupled direct to a 4-pole d.c. interpole generator running at 970 r.p.m. The second set consists of a Brittain induction motor and face-plate starter driving a Vickers 4-pole generator, which has no interpoles, at 950 r.p.m. The third set is an English Electric motor and starter coupled to an Elwell-Parker bi-polar generator; this 15-kW machine is chiefly used for battery-charging purposes. The two 400-volt sets are similar, being 20-kW, 960-r.p.m., G.E.C. motor-generators with G.E.C. starters and Ellison main switches. A simple switchboard controls the converting plant, but the battery-charging board is not shown in fig. 1; it is of normal type, and provides for five regulating cells. The battery is built up of 64 400-ampere-hour Chloride cells, and in the same room with it are housed the small battery for the Synchronome clocks, there being some 24 large dials in various parts of the factory, and the spare batteries for the four Railodok trucks used in the factory.

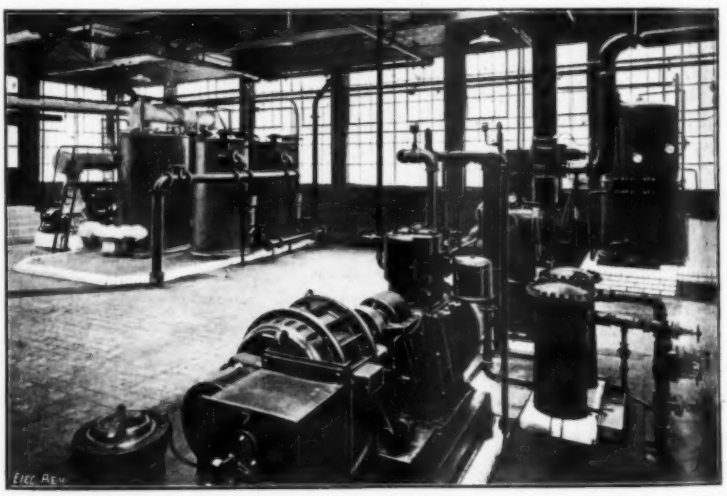

Fig. 7.—Motor-driven Air Compressors.

The truck shown in fig. 6 is a standard 1-ton industrial vehicle fitted with an elevating platform, and is

Fig. 6.—Railodok Electric Truck.

Fig. 8.—Electrically-driven Emergency Fire Pump.

used by itself and also in conjunction with wheeled "trays," which can be loaded and unloaded without keeping the truck idle while doing so; the truck is run under the tray and its platform elevated to lift the tray off the ground.

A transporter was supplied by Messrs. H. Morris, Ltd., to unload tea and other raw materials from barges in the dock, the goods being delivered either to the Tea Block platform or on to lorries, &c., alongside. It has three separate d.c. 400-V motors for the three motions, the hoisting machine being rated at 3½ h.p., that for the travel at 3¾ h.p., and the one for the bridge movement at 4½ h.p.

Altogether there are at present about 190 motors in the Greenford factory, having a total horse power of about 2,500, in addition to some 110 small fan motors on industrial Stanlock heaters. The motors include the three above-mentioned hoist machines and four for operating lifts. In the Tea Block care has to be exercised to exclude dust from the motors and gear; they are accordingly housed in special rooms, and in this case are 20-h.p., 958-r.p.m. English Electric induction motors with G.E.C. switches and starters and belt drives. In other parts of the factory the motors are arranged to suit local conditions, and chain speed-reducing gear is frequently introduced between the motor and the driven shaft. Other typical machines are motor-driven air compressors for air-lift pumping, fig. 7, centrifugal pumps, and motor-driven refrigerating CO_2 compressors, the latter being shown in fig. 5, while fig. 8 illustrates an emergency fire pump which has been installed to reinforce the supply of water to the hydrants that is normally obtainable from the water tower. The set was supplied by Messrs. Mather & Platt, Ltd., and consists of a 70-h.p. induction motor driving a centrifugal pump at 1,470 r.p.m. capable of delivering 650 gallons per minute against a head of 230 ft.; a standard oil switch and a Geo. Ellison oil-immersed starter complete the equipment.

It is obvious that such an electrical equipment, and, moreover, one that is still growing, needs a considerable staff to keep it in proper working condition. All the motors in the factory, with the exception of a few small machines, are started and stopped by the electrical staff; every motor is inspected at least once a day and overhauled at least weekly. The electrical staff is organised on a shift system, there being four men working an average of 47 hours per week, so that at least one of them is available at all times of the day and night in the event of an emergency.

Mr. A. Goddard, the firm's chief electrical engineer, and his assistant, Mr. G. Douglass, are to be congratulated on having equipped the factory on such sound and effective lines.

LIGHTING AND POWER NOTES.

(*Continued from page 320*).

Glasgow.—Unemployment Relief.—In pursuance of a policy for the relief of unemployment, the Electricity Committee has placed contracts for the erection of two new sub-stations, amounting to £14,023, and it is contemplated that the construction of the second portion of the Dalmarnock power station will be proceeded with during the coming winter, the cost of the buildings, including a railway bridge, being estimated at £175,000.

Greenock.—Unemployment Relief Schemes.—Among the schemes for the relief of unemployment which have been submitted by the Corporation to the Unemployment Grants Committee, according to the *Glasgow Herald*, is one for the expenditure of over £100,000 in connection with the electricity undertaking.

Hawarden.—Electricity Supply.—The Electricity Commissioners have decided to grant the Rural District Council a Special Order to supply electricity in the Hawarden area, and at the same time to permit Chester Corporation, in special circumstances, to supply it to a number of premises in the rural district. The order granted to the Chester Corporation remains in force until the Hawarden Council is able to provide the premises concerned with electrical power "on reasonable terms." The total number of premises the Chester Corporation has to supply in the area is 214.

India.—Cochin.—The *Times of India* reports that the contract for electric lighting in Cochin has been re-awarded to Messrs. Crompton & Co. (Madras). This contract was given to Messrs. Crompton in the first place, but eventually transferred to the Cochin State Hydro-Electric Syndicate. The company is negotiating for the lease of land near Calvetty for the erection of a power station.

Broach (Bombay).—The Broach Electric Supply and Development Corporation, Ltd., has commenced the partial supply of electricity in the district. The full scheme is expected to be put into operation next month.

Calcutta.—A progress statement issued by the Calcutta Electric Supply Corporation, Ltd., shows that the sales of energy during the first six months of the current year totalled 30,828,992 kWh, as compared with 24,089,365 kWh during the first half of 1922.

Irish Free State.—Kinsale (Co. Cork).—At a recent meeting of the Urban Council the tender of Messrs. James O'Neill and Sons, of Kinsale, for the public lighting of the town by electricity, at £200, was accepted.

Liffey Power Scheme.—The River Liffey Syndicate, Ltd., is now engaged in making trial borings for the new power storage reservoir at Poulaphouca, Co. Wicklow, in connection with its hydro-electric scheme.

Lees (near Oldham).—Electricity Supply.—Arrangements for introducing electric light in the town are well in hand, and it is anticipated that the installation will be completed before the winter.

Lytham-St. Annes.—Failure of Supply.—Due to a deluge of rain last week, which caused the flooding of a street box, there was a temporary failure of the electricity supply, arising from a short circuit. It took about 24 hours to effect the necessary repairs before the supply could be restored.

Northern Ireland.—Markethill (Co. Armagh).—The Markethill Electric Lighting Co., recently formed, has made excellent progress, and it is expected that the system will be in operation early in September. Electricity for lighting will be supplied at 1s. per kWh.

Perth.—Year's Working.—At a recent meeting of the Town Council it was announced that the revenue of the electricity undertaking for the past year was £31,133. The working expenses totalled £20,218, leaving a gross surplus of £10,915. This was sufficient to meet all capital charges, and a surplus of £2,670 was transferred to the reserve fund. In 1921-22 the financial results were:—Revenue, £31,608; expenditure, £23,818; gross surplus, £7,790; net profit, £587. The amount of energy sold was 2,101,866 kWh, an increase of 208,305 kWh. The capital expenditure upon extensions, mains, &c., during the year was £26,397. It is proposed to reduce the charges for electricity as follows:—Lighting, 15 per cent., and power, 10 per cent. The price of energy supplied to the tramways is also to be reduced.

Peterborough.—Year's Working.—The accounts of the city electricity undertaking (engineer: Mr. H. A. Nevill) for the year ended March 31st last record a total revenue of £32,828, as compared with £34,561 in 1921-22. The working expenditure decreased from £29,344 to £19,989, leaving a gross profit of £12,838, as against £5,217 in the previous year. After deducting loan charges there remained a net deficit of £5,372; in the preceding year the deficit was £6,538. In addition to this there was an adverse balance of £380 on the special net revenue account, the total unemployment grants received being insufficient to meet the extra expenditure. There was an expenditure of £73,574 on capital account during the year, including £14,565 on account of buildings, £21,612 for boilers, and £23,943 for machinery, switchgear, &c.

The amount of energy sold rose from 1,973,936 to 2,215,853 kWh; the maximum demand from 1,615 to 2,000 kW; and the plant capacity from 1,740 to 4,000 kW.

Price Reductions.—Reductions in the charges for electricity have been made in the following districts:—

Stirling.—New scale. Lighting, 6d. per kWh; power 4d. to ½d. per kWh; heating, first 160 kWh, 2d. per kWh, and energy in excess of this amount 1½d. per kWh.

South Shields.—Lighting reduced from 6d. to 5d. per kWh.

South Africa.—Large Water-power Project.—As the result of investigations carried out by Mr. W. Eladon Dew, it is reported that 10,000 h.p. can be developed from the falls of the Mulungushi river, a tributory of the Zambesi, which are said to be three times the height of the Victoria Falls. It is proposed to develop 2,500 h.p. in the first place, and the station is expected to be put into operation in 1925. The work is to be undertaken, according to *The Times Trade and Engineering Supplement*, by the Rhodesia Broken Hill Co.

United States.—Large Water-power Project.—The Federal Water-Power Commission has granted a licence to the Alabama Power Co. to enable it to develop 105,000 h.p. from the Tallapoosa River. The project necessitates the erection of a large dam, 105 ft. in height, to create a storage reservoir. This is stated to be the first of a series of five or six developments planned by the company on the Tallapoosa River with an aggregate capacity of 450,000 h.p.

TRAMWAY AND RAILWAY NOTES.

Belgian Congo.—Railway Electrification.—The scheme for the improvement and electrification of the railways in this Belgian Colony provides for an extensive utilisation of the water power available. Six sites have been selected as suitable for development, the largest being at the Zongo-Matenda and Sengele Falls, where it is hoped to harness 71,000 h.p. In the aggregate 113,000 h.p. is marked for development.

Bradford.—Year's Working.—The accounts showing the working results for the year ended March 31st last of the Corporation tramways (manager: Mr. R. H. Wilkinson), show a total income of £662,731 and a working expenditure of £470,986. In the previous year the revenue was £682,870 and the expenditure £539,483. Thus the gross profit increased from £143,387 to £191,745. The revenue account of the railless system records an income of £21,230 and an expenditure of £26,527, leaving a gross deficit of £5,297, as compared with an adverse balance of £8,068 in 1921-22. The parcels department earned a gross profit of £1,396 (£2,576 deficit in 1921-22). The final results were as follows: Tramways, £65,108 profit; railless system, £7,946 deficit; and parcels department, £510 profit; representing a total net profit of £57,672 as compared with £56,616 in the previous year. The number of passengers carried was 85,289,558 (tramways, 82,046,210) as against 79,620,044 (tramways, 76,708,391) in the preceding year. The car mileage was 6,513,814 (tramways, 6,121,622) as compared with 6,132,403 (tramways, 5,762,515).

The report states that in accordance with a decision of the City Council, one-man vehicles are to be substituted for the present railless cars as the latter become obsolete, and that six vehicles of the "one-man" type have already been placed in service.

Canada.—Ontario.—Mr. T. U. Fairlie, engineer of the provincial Hydro-Electric Commission's Railway Department, is at present in Windsor, Ontario, preparing for the construction programme of the hydro railway system at that point. Work will be started in the near future.—*Reuter's Trade Service* (Toronto).

The Finance Commissioner, Mr. Ross, in his annual statement says that during the next few years Toronto must face many large items of capital expenditure for special purposes, aggregating approximately 60,000,000 dollars. Included in this are the following:—Acquisition of Toronto street railway; city's share of cost of railway viaduct on waterfront; consolidation and extension of municipal light and power system; extensions and new equipment for transportation system; and duplicate waterworks system.

The Commissioner estimates that the ordinary capital requirements, including local improvements, exceed 9 or 10 million dollars annually for the next five-year period. The Commissioner adds that the financing of these undertakings should not prove too great a burden if proceeded with in an orderly fashion and with due regard to the growth and needs of the city.—*Reuter's Trade Service* (Toronto).

Continental.—Germany.—In consequence of the enormous losses on the Berlin tramways, the Municipality has decided to suspend the services and to give notice to all employés. It is announced at the same time that every step is being taken to resume the services at the earliest possible date. Negotiations have been opened with the Government with a view to securing its assistance in the maintenance of the services.—*Reuter* (Berlin, August 22nd).

Italy.—A company has just been formed at Rome, under the title of the Società Metropolitana di Genova, for the construction and working of an electric railway between Sampierdarena and Quarto del Mille at Genoa. The share capital is 5,000,000 lire, and can be increased to 80,000,000 lire. Most of the promoters and directors are Spaniards, and belong to the syndicate which constructed the metropolitan lines in Madrid and Barcelona.

Darwen.—Year's Working.—There was a profit of £2,994 on the working of the tramway undertaking during the past year.

Dundee.—Season Tickets.—The Tramways Committee has decided in favour of season tickets on the tramways. It is proposed to make the following charges:—1d. stages, 11s. per month, or 30s. per quarter; 1½d. stages, 14s., or 42s.; 2d. stages, 17s., or 51s.; 2½d. stages, 20s., or 60s.; 3d. stages, 23s., or 69s.; 4d. stages, 90s. 3d. per quarter.

East Ham.—Year's Working.—The revenue of the municipal tramways for the year ended March 31st last was £103,250, as compared with £113,250 in the previous year, while the expenditure was £93,327, as against £111,123. The gross profit of £9,923 (£2,127) was insufficient to meet the capital charges, and the net result was therefore a deficit of £8,834. This, however, compared favourably with the previous year's loss of £18,331. £19,285 was spent on capital account during the year, principally in respect of the permanent way. The number of car-miles run increased from 1,414,954 to 1,487,829, and the number of passengers carried from 16,689,698 to 18,165,512, resulting in an improvement in the number of passengers per car-mile from 11.79 to 12.21.

Edinburgh.—Extensions.—The Corporation proposes to extend the tramways when the necessary Parliamentary powers have been obtained. The extensions proposed are from Leith to Portobello; from the present Slateford terminus to Slateford village; from Braids to Lothianburn; and an extension at Willowbrae Road, with probable extensions to Duddingston and Portobello.

London.—Extension of Lots Road Station.—It is announced that the "Underground" power station at Lots Road, Chelsea, is to be extended by the addition of another 15,000-kW turbo-generator. This will meet the demands of the new railway extensions, and it is also intended to gradually transfer the load on the Wood Lane station to Lots Road, until the former is finally closed down.

TELEGRAPH & TELEPHONE NOTES.

Australian Cables.—Rate Reduction.—On September 1st the rates for week-end letter telegrams to Australia and New Zealand *via* the Imperial and Pacific cables will be reduced. On the same date a new daily letter telegram service *via* the Imperial and Pacific cables will be inaugurated to those countries at one-quarter of the ordinary rates.

Lapland.—Telephone Service.—The Stockholm correspondent of the *Daily Mail* reports that telephone lines are to be laid to the most northerly portions of Lapland in order that the nomad tribes of Lapps may be given meteorological bulletins. The Lapps are scattered over the north of Sweden and Norway and the north-west of Russia, north of the Arctic circle.

New United States Cable.—There is every possibility that an English firm will secure the £300,000 contract for the laying of a new cable between Seattle and Alaska. Col. Gibbs and Col. Griffin, both of the U.S. War Office, arrived in London last week in connection with the contract as representatives of the U.S. Government. The length of the cable required is nearly 2,000 miles.—*Evening News.*

RADIO-TELEGRAPHY AND TELEPHONY.

Austria.—Government Monopoly.—The Austrian Government announces that both radio telephony and radio telegraphy are to be retained as State monopolies. The right to develop services between Austria and other countries has been leased to the Marconi Co. Negotiations, however, are pending with regard to an inland service, particularly as to broadcasting and ordinary radio telephony, which have so far remained entirely neglected in Austria.

The concession in this case will only be granted to an Austrian firm or an amalgamation of such firms under the condition that exclusively Austrian machinery and appliances are installed. A number of applications for concessions have been received. The concessionaires will be entitled to fix their own tolls and rentals, in which the Government will participate on a percentage basis.—*The Times.*

Australia.—Broadcasting Regulations.—The regulations relating to broadcasting, which it is hoped will be gazetted shortly, were, in the first instance, drafted at a conference called by Mr. Gibson, Postmaster-General, at which representatives from all the States attended: they were afterwards revised by a committee representing those interested in radio telephony and are to be submitted to the Cabinet at the first opportunity. The Australian Press understands that the new regulations will authorise the establishment of radio broadcasting companies, each operating on a fixed wave length. The sole source of revenue of these companies is to be the fees collected by them from those wishing to listen. It is proposed to restrict the sale of receiving apparatus to sealed sets, which will respond to only one distributing station. Before obtaining such a set, the intending purchaser must pay a Government licence fee, and, in addition, the subscription to the broadcasting company, which may be anything from £5 to £30 per annum. It is stated that the service will be established on a competitive basis; and that provision has been made for different services for those who desire them. In the city there will be a high-grade service by a large company, while in rural districts smaller local companies, municipalities, or co-operative concerns will provide a service in conformity with the needs of the particular district.

The listener will be required to pay an additional fee to every additional broadcasting company if he desires to listen to other announcements and entertainments. It has been suggested as an alternative that dealers in Melbourne should erect and operate broadcasting stations, charging no fees to those availing themselves of the programmes, and paying for the upkeep of the stations from the profits on the sales of adaptable receivers.

Lithuania.—Radio Telegraphy.—The Minister of Communications, according to reports in the Lithuanian Press, is negotiating with the Marconi Co. regarding the erection of a big radio station in Lithuania.—*Reuter's Trade Service* (Kovno).

Norway.—New Radio Station.—The Director of the Norwegian Telegraph Services recently returned from a tour of inspection in the northern provinces, where he prepared the plans for the new radio station to be erected at Vardoe. This station will have a transmission radius sufficient for messages to be sent to the station at Ingoe, near Hammerfest, and to the Meteorological Institute's station at Tromsoe. Weather reports are to be sent regularly from Tromsoe, and they will be of very great importance to British and other trawlers fishing in Arctic and White Sea waters.—*Reuter.*

Radio-Broadcasting.—Forecast of Committee's Report.—According to the daily Press, the report of the Radio Broadcasting Committee was submitted to the Postmaster-General (Sir L. Worthington-Evans) on the 24th inst. It should be remembered that the committee is a private one, acting in a purely advisory capacity to the Postmaster-General, who is not bound by its recommendations and may or may not act upon them as he chooses without necessarily seeking Parliamentary action.

The main recommendation of the committee is that a single licence for listeners and experimenters should be issued at a uniform fee of 10s. The committee's ideas do not embrace any form of protection for British makers of sets and parts. It declares that the point concerns the Government and Parliament, but the tone of its opinions is against protection. A strongly-dissenting minority report is signed by Mr. J. C. W. Reith, general manager of the B.B.C., and representative of the broadcasters on the committee. The majority report recommends: The creation of a single Post Office licence to cover any set, whether purchased ready-made or assembled at home, and whether manufactured by B.B.C. firms, outside British firms, or by foreign firms. This licence to be easily obtained by experimenters and amateur listeners alike. Abolition of the present tariff system (under which only those sets can be licensed which are stamped "B.B.C.," a fee on each instrument ranging from 5s. to £3 going to the B.B.C. itself as broadcasting subsidy). A fluctuating proportion of the 10s. licence fee to go to the B.B.C. The proportion is basically three-quarters (7s. 6d.), but it would be slightly reduced if very large numbers of licences were issued.

With a reservation as to the B.B.C.'s present agreement with the Government, it is held that there is no reason why firms outside the B.B.C. should not be allowed to conduct broadcasting stations. The service so far given by the B.B.C. is warmly commended. In the committee's opinion both the method of operating the stations and the programmes indicate efficiency.

One controlling authority of broadcasting and receiving in Britain—to be either the Post Office or a separate body appointed by and responsible to the Government—and more relay stations are recommended as giving greater facilities to the listener. The manufacturers' plea that makers and dealers in sets and parts should be licensed is not approved.

CONTRACTS OPEN AND CLOSED.

(The date given in parentheses at the end of the paragraph indicates the issue of the Electrical Review *in which the "Official Notice" appeared in our advertisement pages.)*

OPEN.

Aberdeen.—September 17th. Electricity Department. Coal-handling plant. (See this issue.)

Australia.—Sydney.—September 24th. Municipal Council. Consumers' meters and sub-station apparatus. December 3rd. 33,000/5,000-V switchgear and apparatus for sub-stations. November 19th. Step-down transformers.*

December 3rd. H.p. switchgear and apparatus.*

October 31st. N.S.W. Government Railways and Tramways Department. Three steam turbine-driven centrifugal boiler feed pumps, air washer and humidifier. October 24th. Rotary-converter sets.*

Brisbane.—September 19th. Postmaster-General's Department. Telephone apparatus and parts. October 3rd. Switchboard apparatus and parts. October 10th. Protective apparatus.*

Perth (W.A.).—October 10th. Postmaster-General's Department. Battery plates, wood separators, &c. October 31st. Telephone and telegraph apparatus, testing instruments, &c.*

Belfast. — September 7th. Electricity Department. 3-phase e.h.p. switchgear. (See this issue.)

Belgium.—September 7th. Belgian Post and Telegraph authorities, La Salle Madeleine, Brussels. 43 lots of telephonic apparatus and accessories.

September 8th. Municipal authorities of Hecht (Province of Limbourg). Establishment of a l.p. electricity distribution system in the town. (Particulars 15 fr.)

September 5th. Minister of Railways, Marine, Posts and Telegraphs. 23 lots of telephone wires, apparatus and accessories.*

September 5th. State Railway Authorities (Office de l'Electricité), 25, Rue de la Charité, Brussels. The supply and laying of two lots of underground cable, one at Chatelineau and one at La Louvière.

Antwerp.—October 16th. Municipal Authorities. Fifteen 3-ton electric cranes. Particulars for 3 fr.

September 7th. The municipal authorities of Beverst (Province of Limburg) are inviting tenders for the establishment of a low-pressure distribution system in the town. Particulars for 20 fr.

September 6th. Municipal Authorities of Schaerbeek, Brussels. Supply of 375 joint boxes, and 200 electricity meters.

Canada.—Toronto.—October 9th. Municipal Council. A.c. generator.*

Chesterfield.—September 12th. Electricity Department. Electrically-driven induced-draught plant, with starting and regulating gear, dampers, &c. (See this issue.)

Croydon. — September 5th. Electricity Department. 5,000 tons of coal of any of the following grades: Double screened nuts, ¾ in. to 1¼ in.; peas or beans, ¾ in. to ¾ in.; best quality 1¼ in. to 1¾ in. rough slack. (See this issue.)

Edinburgh.—September 3rd. Electricity Supply Department. Extension of five d.c. feeder panels at Leith sub-station. (August 17th.)

September 10th. Tramways Department. 168 steel tramway poles and scrolls, &c. Forms from the manager.

Farnworth.—September 17th. Electricity Department. One 50-kW rotary converter with transformer, switchgear, instruments, cables, &c. (August 17th.)

Halifax.—September 7th. Tramways and Electricity Committee. One 10,000-kW turbo-alternator, with condenser. (August 17th.)

Hornsey.—September 10th. Electricity Department. L.p. switchgear. (See this issue.)

Ilford.—September 25th. Electricity Department. E.h.p. cable. (See this issue.)

London.—East Ham, E.—September 5th. Education Committee. Wiring Hartley Avenue, Kensington Avenue, and Lathom Road schools for electric light. F. R. Thompson, secretary, Town Hall.

Post Office Stores Department.—September 24th. Supply of Swedish, Norwegian, Finnish or Baltic red fir and home ground larch or Scots fir telegraph poles. The Controller, Post Office Stores Department, 17-19, Bedford Street, W.C.2.

Greenwich, S.E.—September 13th. Board of Guardians. Supplying and fixing tubing for wires for electric lighting, Woolwich Road Institution. Mr. A. Roberts, surveyor, 92, London Street.

India Store Department.—September 21st. Lead-sheathed cable. (See this issue.)

Islington.—September 11th. St. Mary's Board of Guardians. Six months' electrical supplies. Mr. A. King, clerk, St. John's Road, Upper Holloway, N.

Westminster, S.W.—September 12th. Board of Guardians. Electric lamps and fittings. Mr. W. J. Leckley, clerk to the Guardians, Princes Row, Buckingham Gate, S.W.

Bermondsey, S.E.—September 6th. Board of Guardians. Six months' supply of electric lamps. Mr. H. H. Reeve, clerk to the Guardians, 283, Tooley Street, S.E.

Bethnal Green, E.—September 4th. Board of Guardians. Telephone instruments in the Administrative Offices, Bishops Road, Bethnal Green. (See this issue.)

Edmonton, N.—September 10th. Board of Guardians. Six months' supply of electric lamps. Mr. E. Ridley, clerk to the Guardians, 77, Bridport Road, Edmonton, N.18.

Manchester.—September 11th. Tramways Committee. Steel girder tramway rails, steel tramway poles, span wire brackets, and copper bonds. Mr. H. Mattinson, general manager, Corporation Tramways, 55, Piccadilly, Manchester.

Merthyr Tydfil.—September 18th. Board of Guardians. Electrical fittings for six months. Mr. F. T. James, Clerk, High Street.

Northern Ireland.—Belfast.—September 12th. Ministry of Home Affairs (Maintenance Branch).—Twelve months' wireless supplies for the police in Northern Ireland. Secretary, Ministry of Home Affairs (Maintenance Branch), Plough Chambers, 5, Cornmarket, Belfast.

Plymouth.—September 19th. Electricity Department. One 6,000-kW turbo-alternator, condenser, &c., and 1,000-kW converter. (August 17th.)

Salford.—September 24th. Electricity Department. Cooling towers, pumping plant and pipework at Agecroft power station. (See this issue.)

Sleaford.—September 5th. Electricity Department. Pair of feeder cables. (See this issue.)

South Africa.—Johannesburg.—September 18th. Municipal Council. One 2,000-kW converter panel, transformers, overhead tramway equipment, and 500 rolled steel tramcar tires. September 24th. Rotary converter.*

Uitenhage, Cape Town.—September 13th. Municipal Council. Electrical plant.*

Spain.—Lepe (Huelva).—The municipal authorities of Lepe (Province of Huelva) are inviting tenders for the concession for the electric lighting of the town.

Stoke-on-Trent.—September 12th. Electricity Department. Two cooling towers (200,000 gallons each), with cooling ponds and accessories. (See this issue.)

Uruguay.—Montevideo.—October 15th. Comision del Palacio Legislative. 286 electric light chandeliers and brackets.*

October 15th. State Electricity Works. L.p. armoured cable, telephone cable, and accessories.*

Warrington.—September 18th. Sanitary Works Committee. Electric vehicle battery-charging plant. (See this issue.)

*Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.1.

CLOSED.

Belgium.—State Railways.—The Administration recently considered tenders for cables from six firms—two Belgian, two British, one Austrian, and one Italian. The Belgian and the Austrian firms were successful. The British firms which competed were Callender's Cable & Construction Co., Ltd., and the British Insulated & Helsby Cables, Ltd.—*Eclairage et Force Motrice.*

Dublin.—Electricity Department. Accepted:—

Cable and accessories.—British Insulated & Helsby Cables, Ltd.
Troughing.—Hammond Lane Foundry Co.
Section pillars, disconnecting boxes, &c.—British Insulated & Helsby Cables Ltd.
Open type flame carbons.—Sloan Electric Co., Ltd., and E. A. Langrishe and Co.
Nine new coal shoots at the Pigeon House electricity works (£266).—Dublin Shipbuilders, Ltd.
Circuit breakers.—Drake & Gorham, Ltd.—*Irish Builder and Engineer.*

Glasgow.—Tramways Committee. Recommended:—

Cable for the subway.—R. S. Newall & Son, Ltd.

Fire Brigade Committee. Recommended:—

Cable in connection with the installation of new fire alarms (£137).—Western Electric Co., Ltd.

Housing Committee. Accepted:—

Electric lighting installation at Caplawhill housing scheme (second development) (£387).—James Laird & Co.

Corporation. Accepted:—

Electric lighting installation at Shettleston and Tollcross Library (£396).—Haddow & Co., Ltd.

Health Committee. Recommended:—

Erection of a switch-house at Belvidere Hospital in connection with the electric lighting installation (£230).—M. Stewart & Co.

Leeds.—Turbine Contract. The Sub-Committee of the Electricity Committee appointed to consider the matter of the tenders of the English and Continental firms for the 10,000-kW turbo-alternator and condensing plant, held its first meeting on Friday last week. As a result of negotiations between the sub-committee and the English firms, says the *Yorkshire Observer*, it is now hoped that the reductions on the original English quotations will be substantial enough to enable the committee to give the order to a home concern. It is understood that the reductions offered are approximately 15 per cent. The meeting of the sub-committee was further adjourned.

Thornaby.—Corporation. Accepted:—

Installing electric lighting in the Town Hall (£89).—Pickersgill & Sons, Ltd.

FORTHCOMING EVENT.

Shipping Engineering and Machinery Exhibition.—At Olympia, W. August 31st to September 22nd.

THE "ELECTRICAL REVIEW" SERVICE DEPARTMENT.

Requests for information must be accompanied by a stamped addressed envelope.

We should be glad if any reader could advise us of the names and addresses of the makers of:—

Miller combined choking coil and switch.

A steriliser bearing marks: D.M.Co., England, 6045143722.

An electric iron bearing marks: two C's interlaced on a shield.

NOTES.

Aircraft Apprentices.—Owing to the decision of the Government to increase the strength of the Royal Air Force for home defence, a large number of apprentices will be engaged, who will be trained as skilled craftsmen. Applicants must be under 17 years of age. Examinations will be held by the Air Ministry (latest date for application, October 2nd). Particulars may be obtained from the Secretary, Air Ministry, Kingsway, W.C.2.

More X-ray Victims.—For 15 years a victim to X-ray dermatitis (inflammation which destroys the skin), contracted during his long service as senior radiographer at the London Hospital, Mr. Reginald G. Blackall had his right hand amputated on August 21st. Last February Mr. Blackall had his left hand removed except the thumb. Though only 40, he has been unable to do active work for two years, but he still acts in an advisory capacity to the hospital.—*Daily Mail.*

A silver medal and a sum of 5,000 fr. have been awarded to Abbé Tauleigne, curé of Pontigny, near Auzerre, by the Carnegie Foundation, for his devotion in continuing to carry on experiments with X-rays after his limbs had been seriously injured by their action.—*The Times.*

Theft of Electricity.—At Maidstone, on August 14th, S. D. Oxley was charged with obtaining more electricity than the quantity for which he was paying by interfering with a current limiter. A meter fixer, giving evidence, stated that upon visiting defendant's premises he found that the seal of the limiter had been broken and that one of the moving parts of the appliance had been wedged up by means of a piece of wood. Defendant and his wife contended that the limiter had not been sealed and that there had been no interference with it. A fine of 40s. was imposed, with an alternative of one month's imprisonment in default of payment.

Appointment Vacant.—Car depôt foreman (£39 per month) for Municipality of East London, South Africa. (See our advertisement pages to-day.)

Accident.—The *Star* reports that fifteen men engaged in the erection of an overhead transmission line at Ponder's End were injured by the breaking of a cable.

Mine Locomotives.—The development of the battery locomotive for use in mines has now reached a stage where danger has been eliminated. In the September *Electric Vehicle* is an abstract from a report recently issued in the United States describing very severe tests made upon battery locomotives, and upon their separate parts, in explosive mixtures of air and gas with coal-dust freely scattered about the casings, by experts of the Bureau of Mines. Manufacturers in this country also are giving attention to the construction of locomotives for mining use. On the safety side of the question, of course, the whole decision as to the use of electric locomotives in mines primarily depends. The other side, economy, needs little emphasis. Analogies may be profitably drawn from an article in the same journal on the work of the storage-battery locomotive in the London Tube extensions; apart from the nature of the atmosphere, the work is not dissimilar from mining work—the men employed in excavating being, in fact, miners. The increased cost, both in maintenance and through lack of speed, if pony haulage were to be substituted for the expeditious locomotive, would soon be felt. The storage-battery locomotive, either for main haulage or as a feeder to terminal points of long-distance transport, is the true solution of the recurring problem of the pit pony.

"English Electric" Gliders.—The English Electric Co., Ltd., is building two motor gliders of the "Wren" type at Preston, for the competitions at Lympne Aerodrome, Kent, on October 8th. The prizes are £1,000 for the longest distance in one flight, and £500 for the longest flight by a British competitor in an all-British machine. The "Wrens" being built in the Preston works will be practically identical with the machine in which Major M. Wright secured excellent results in trial flights at Lytham recently. They will be fitted with 3 h.p. motor-cycle engines.

Railway Electrification Justified.—In an article dealing with the Norfolk & Western Railway, which was electrified seven or eight years ago, the *Electric Railway Journal* says that the primary purpose of the electrification was to increase the track capacity, and the result was satisfactory from the start. A dozen electric locomotives replaced thirty-four or more of the then most perfect Mallets. It was found to be possible to handle twenty coal trains eastbound daily, as well as to help six freight and passenger trains up the grade, the total eastbound tonnage being 65,000 tons daily. In 1917 the electrical engineer of the railway stated that during the preceding year nine electric locomotives had handled a fifth more freight than forty-three steam engines had done in 1914, the normal number in service being respectively seven and twenty-four. The cost per million tractive-miles was reported to be 12½ per cent. less with electricity than with steam.

The electrification was in full operation before the breaking out of the war, and it was an important factor in delivering large quantities of coal for use on naval and merchant ships.

Radio Notes.—Quite a number of ships, and not only passenger ships, are now fitted with wireless direction-finders; according to an official of the Marconi Company, about seventy vessels have them actually in use, while fifteen more are in course of being fitted. Many are being used on the Atlantic route, and the *Majestic* on a recent voyage east found the apparatus exceedingly useful in thick fog. The vessel obtained a large number of bearings from U.S.A. shore stations, and also ascertained *en route* the positions of two Cunarders, the *Mauretania* and *Tyrrhenia*, which were approaching the American side from Europe. The banana boats of Messrs. Elder & Fyffe are also using direction-finders.—*The Times.*

In connection with the recent military manœuvres in Sussex, *The Times* records that the new military wireless telegraph sets, which have not been tried before in real or mimic operations, have been put through searching tests. The "C" set, which has a range of between 20 and 60 miles and can be carried on a Crossley tender or a four-horsed limber, has been used with complete success for communication between divisional and brigade headquarters. The "A" set, light enough to be carried by four men or in mule panniers, with a range limited approximately to six miles, has linked up brigade headquarters with battalions, and although its success perhaps has not been so absolute as that of the weightier installation, it has given promise of a complete success soon to be achieved. Radio telephony between "contact" aeroplanes and divisions, brigades, and battalions has been utilised during the training, although, in the case of the last-named, their part, with a set weighing only 15 lb., has been limited to receiving messages from the observers overhead. Telephonic communication, too, between tanks on the move has been shown to be possible during the field operations, so long as they are no more than five or six miles apart.

Educational.—University College of Swansea.—The College authorities have issued a prospectus of the Department of Engineering for the 1923-24 session. This sets out in detail conditions of entry, particulars of courses, personnel, facilities, and many other matters.

Loughborough College.—The recently-published "Calendar" for the 1923-24 session is a bulky volume containing exhaustive details of the curricula, teaching staff, and amenities, and a full list of those who have acquired the College's diploma.

Municipal College of Technology, Manchester.—The 1923-24 prospectus contains exhaustive details of the College's degree courses in many arts and sciences. Particulars are given of the degree of Doctor of Philosophy (Ph.D.) which has been instituted recently.

School of Accountancy.—The school authorities have issued a brochure dealing with their evening classes and correspondence courses.

University of London, University College.—A Goldsmid Entrance Scholarship of the value of £120, tenable in the Faculty of Engineering of University College, London, will be awarded in September. Entry forms must be received by the Secretary of the College not later than September 8th. In connection with the examination for the scholarship, five bursaries may be awarded to engineering students who require financial help to enable them to take a university course in engineering.

A Reconstructed Transmission Line.—During the past year the Niagara, Lockport & Ontario Power Co., of Buffalo, New York, completed the reconstruction of a 60,000-V, single-circuit pin-type insulator steel-tower line to a double-circuit, 110,000-V line. The original line was built in 1906 with 550 ft. spacing and 214,000-cir.-mil full aluminium cable with 19 ft. sag and 30 ft. ground clearance. Through the use of aluminium cable, steel-reinforced, and pulling this cable to a sag of 10½ ft., it was possible to install two circuits and maintain a ground clearance of not less than 25 ft. The decreased sag, of course, required much stronger structures at dead-end and deflection points, which were taken care of by new towers. Moreover, in some instances, the intermediate suspension towers had to be raised by 5 ft. or 10 ft. More than 80 per cent. of the old towers and 90 per cent. of the old foundations could be utilised for this new construction. An analysis of the cost of the completed construction showed that the company saved at least $2,000 a mile in tower construction by utilising the old towers and old foundations wherever possible.—*Electrical World.*

A Belgian Electrical Museum.—The *Eclairage et Force Motrice* states that an electrical museum is being arranged by the Chambre Syndicate des Electriciens, with the support of the Société Belge d'Electriciens, at the Palais du Cinquantenaire, Brussels. Here will be grouped not only examples of modern electrical apparatus, but appliances possessing historical interest although obsolete. The collection will include drawings, books, and souvenirs of those who have contributed to the progress of electricity.

Electric Lorry Trials in France.—From September 25th to October 10th a series of electric lorry trials will be held near Paris, the first event of its kind to take place in France, and one for which a union of all electrical manufacturing associations in the country is responsible. Prizes will be awarded for five classes of vehicles, distinguished by weight-carrying capacity as follows:—Maximum load 500 kilos., 501 to 1,500 kilos., 1,501 to 3,000 kilos., 3,001 to 5,000 kilos., and more than 5,001 kilos. useful load. The lorries will be tested on the road for ten consecutive days, and will be required to cover distances decreasing with their load capacity. For the ½-ton vehicles the distance will be 50 miles, for the 1½-tonners 43 miles, for the 3-tonners 37 miles, and for all heavier vehicles 31 miles daily run.

The successful competitors will have to qualify on a basis of regularity of running and amount of energy consumed per ton-kilometre, useful load and total load both being considered. The energy consumed in charging during the whole period will be recorded, and the weight of the batteries will be noted, as well as their nominal capacity for a given rate of discharge during five hours.—*Electric Vehicle.*

Standardisation of Lamp Bulbs for Motor Cars.—The satisfactory announcement is made that the principal manufacturers of electric lamps and lighting apparatus for motor-cars have agreed with the Electric Lamp Manufacturers' Association of Great Britain to design their lamps so as to take a reduced series of standardised bulbs. It is estimated that hitherto there have been some 110 different types of bulbs in use, which has made the matter of obtaining the correct bulb a difficulty for the user as well as rendering it anything but easy for dealers in electrical equipment and garages to meet the demand. In future there are to be seven sizes of bulbs for headlamps—*viz.*, four gasfilled round bulbs—6-7 volts, 12 or 18 watts, and 12-14 volts, 24 and 36 watts—and three vacuum round bulbs—6-7 volts, 12 watts, and 12-14 volts, 24 or 36 watts. For side, tail, and dash lamps there will be three sizes of vacuum bulbs—*viz.*, 6-7 volts, 3 and 6 watts, and 12-14 volts, 6 watts. Any of the standard bulbs are available in the following brands: Bell, Cosmos, Crysalco, Royal "Ediswan," Mazda, Osram, Elasta, Siemens, Stearn, and "Z," while as a result of the standardisation considerable reduction in the retail price is announced to come into operation on September 1st.

INSTITUTION NOTES.

Institution of the Rubber Industry.—The first meeting of the 1923-24 session is to be held at the Engineers' Club, Coventry Street, W., on September 17th. Mr. Evan J. Edwards, of the North British Rubber Co., Ltd., will read a paper on "Rubber Floors and Rubber Roadways."

The Liverpool Engineering Society.—On and after September 1st, 1923, the address of the Society will be: 9, The Temple, Dale Street, Liverpool.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.

The *Yorkshire Post* reports that Mr. E. J. Jarvis, at present resident engineer to the North Metropolitan Electric Power Supply Co., has been appointed electrical engineer to the Ilkley Urban Council. Mr. Jarvis will take up his new duties on October 1st. There were 110 applicants for the position. The same journal also records the appointment of Mr. P. Clegg, B.Sc., of Rochdale, to the position of electrical engineer to the Bingley Council in succession to Mr. F. L. Pedley. Mr. Clegg assumes his new office on September 1st.

Blackburn Electricity Committee has appointed Mr. B. A. M. Cooper mains superintendent in succession to the late Mr. T. Wallwork. Mr. Cooper was formerly in the service of the Electricity Department of the Corporation and is at present engaged in the contract department of Messrs. Johnson & Phillips, Ltd. There were 48 applicants for the post.

The marriage took place, on August 11th, at St. Augustine's Church, Holly Hall, of Mr. W. F. C. H. Woodworth, electrical engineer, of Smethwick, and Miss Ida Annie Powell, only daughter of Mr. J. H. Powell, of High Street, Holly Hall.

After to-morrow the address of Dr. S. Parker Smith, late of the City and Guilds (Engineering) College, London, will be The Royal Technical College, Glasgow.

On August 24th, at St. Martin-in-the-Fields, London, Flossie May, only daughter of Mr. and Mrs. J. W. Elliott (lamp sales manager, Edison Swan Electric Co., Ltd.), was married to Mr. Richard M. Clark, M.C., B.Sc., second son of Mr. and Mrs. Clark, of Brentwood, Essex.

Mr. J. K. Gellatly, who for the last nine years has been associated with Messrs. Siemens's various companies, has now been appointed sole representative for Scotland for The Liverpool Electric Cable Co., Ltd., and The London Electric Wire Co. and Smiths, Ltd., who are jointly opening a branch at 51, Renfield Street, Glasgow, on September 1st. Large stocks of cable and all classes of covered wires will be carried.

Obituary.—Mrs. Hertha Ayrton.—We learn with great regret that Mrs. Hertha Ayrton, M.I.E.E., widow of the late Professor W. E. Ayrton, died on August 26th at North Lancing. Mrs. Ayrton, the daughter of Mr. Levi Marks, was educated at Girton, and studied science under Professor

Ayrton at the Central Technical College, London. After their marriage in 1885 she continued her studies, and in 1893, during the absence of Professor Ayrton in America, she completed a series of experiments on the electric arc which he had commenced. Subsequently Mrs. Ayrton carried out extended researches on this subject and became the leading authority on the physics of the arc, her book on "The Electric Arc," published in 1902, being recognised as a classic work. In view of the importance of her researches, Mrs. Ayrton was elected a member of the Institution of Electrical Engineers—the first and, until recently, the only woman member; and she would doubtless have received the coveted title of Fellow of the Royal Society had it not been decided that the Council had no legal power to elect a woman. However, in 1906 she was awarded the Hughes medal of the Royal Society, being the

Photo by *Press Photo. Agency.*

MRS. HERTHA AYRTON.

first woman so honoured in respect of her own achievements. Amongst other subjects which she studied were the causes of the formation of sand ripples on the seashore and the movements of water in oscillation. She also invented a gas-dispersing fan for hand operation, which was used at the front during the war, over 100,000 being supplied to the troops. Mrs. Ayrton read scientific papers before the Royal Society, the Institution of Electrical Engineers, the British Association, and other bodies, and took part from time to time in discussions relating to her special subjects. Her only daughter is the wife of Mr. Gerald Gould.

Mr. A. M. THOMPSON.—The death occurred, on August 20th, at Hayling Island, Hants, of Mr. Arthur Moore Thompson, M.Inst.C.E., M.I.E.E., late of Holly Bank, Crewe, aged 76.

W. H. MORTON.—The death is reported from New Zealand, says the *Commonwealth Engineer*, of Mr. W. H. Morton, city engineer and general tramway manager of Wellington, N.Z. Mr. Morton was originally in the public works department of Victoria, and was appointed by the Wellington, N.Z., City Council, in 1903, city engineer, which combined the other duties of city surveyor, building surveyor, engineer of water and sewerage, and, when electric lighting and tramways were installed, he became, in addition, manager of lighting and tramways. He was 56 years of age.

Mr. GORDON BRYANT.—We regret to record the death of Mr. Gordon Bryant, A.M.I.E.E., electrical engineer to the Corporation of Yarmouth, on August 24th, after a fortnight's illness. Mr. Bryant went from Southampton to Yarmouth 28 years ago and was appointed chief electrical engineer in 1898, in which capacity he showed marked ability. He was in his 50th year and leaves a widow and a young family.

NEW COMPANIES REGISTERED.

Atlas Wireless Co., Ltd. (191,991).—Private company. Registered August 20th. Capital, £1,500 in £1 shares. To carry on the business of manufacturers and designers of wireless apparatus, scientific and electrical instruments, &c. The first directors are:—R. J. Coley, 24, Norbiton Avenue, Norbiton, general merchant; H. J. Rochester, 3, Victoria Villas, Richmond, barrister's clerk; A. E. Clarke, 78, Richmond Road, Kingston, wireless engineer. Registered office: 78, Richmond Road, Kingston-on-Thames.

Wireless Construction Co., Ltd. (191,987).—Registered August 15th. Capital, £1,000 in £1 shares (500 preference and 500 ordinary). To carry on the business of manufacturers of and dealers in drawn wire, electric cabling and electric lamps and all articles made from tungsten, molybdenum and other metals, and all parts, accessories and articles used in the manufacture of electrical instruments, &c. The subscribers (each with one share) are:—G. A. Hagon, 3, Freegrove Road, Holloway, N.7, law stationer; J. R. Quin, 26, Grosvenor Road, Westcliff-on-Sea, insurance clerk; F. N. Quin, 21, Longbeath Road, Clapham Common, S.W., company secretary; Miss I. M. Quin, 26, Grosvenor Road, Westcliff-on-Sea, shorthand typist; Miss R. N. Quin, 26, Grosvenor Road, Westcliff-on-Sea, shorthand typist; A. E. Gay, 61, Linden Gardens, Chiswick, W.4, auctioneer and valuer; W. H. Lane, 41, Gordon Road, Carshalton, solicitor. Minimum cash subscription, 7 shares. No persons had consented to act as directors to August 17th. Remuneration, £50 each per annum (chairman, £25 extra). Secretary (*pro. tem.*): H. Cachow. Registered office: Suffolk House, Laurence Pountney Hill, E.C.

Parkside Engineering Co., Ltd. (192,104).—Private company. Registered August 24th. Capital, £1,550 in £1 shares (10 "A" and 1,540 "B"). So soon as 10 debentures of £75 each, to be issued by the company in 1923 to G. H. Kellett, are paid off or cancelled, the differentiation between the "A" and "B" shares is to be cancelled, and meanwhile each "A" share bearing the same number as any of the said debentures for the time being outstanding shall carry 75 votes, as against one vote conferred by each other share. To carry on the business of motor engineers, garage proprietors, electrical engineers, scientific instrument makers, manufacturers of wireless apparatus and accessories, &c. The permanent directors are:—W. W. Witham, 153, Castlenau, Barnes, S.W.13, engineer; G. H. Kellett, Bramble Cottage, Ashby-cum-Fenby, near Grimsby, gentleman. Qualification, £20. Registered office: 28, Sheen Lane, East Sheen, S.W.14.

Radions, Ltd. (192,105).—Private company. Registered August 24th. Capital, £6,000 in 3,000 10 per cent. cumulative participating preference shares of £1 each and 12,000 ordinary shares of 5s. each. To manufacture, repair, re-make, let on hire, and deal in thermionic valves and all kinds of apparatus connected with radio telegraphic or telephonic, wireless or broadcasting apparatus, electric lamps, &c. The first directors are:—G. D. G. Leadbetter, Stravally, Westgate, Hale, engineer; H. J. Osborn, 4, Alder Avenue, Chinley, Stockport, engineer; W. J. Pattison and W. L. Turner, no addresses given. The holders of the participating preference shares No. 1-1,000 shall appoint one of their number to be a director. W. L. Turner being the first. The holders of the remaining participating shares shall also appoint one of their number to be a director. The remaining directors are to be appointed by the ordinary shareholders. Qualification, 200 shares. Registered office: 2, Marsden Street, Manchester.

Magnetic Signs and Carriers, Ltd. (192,055).—Registered August 22nd. Capital, £5,000 in £1 shares. To acquire a system of advertising and car construction from S. A. Grimes, 18, Gerrard Street, W.1, and to carry on the business of advertising contractors, carriers, and advertisers by means of electrical and other signs. The purchase consideration is £800 (£200 in shares immediately and the balance of the issue of £20 shares for each £100 allotted for cash after first 1,400 have been allotted). Promoter: A. G. H. Wilson, who receives £200 shares for his services and expenses, excluding registration fees. Minimum cash subscription, 7 shares. The first directors are:—C. E. Snoxall, 11, King's Road, Willesden Green, N.W.10, gentleman; T. B. Terry, 42, Queen's Gardens, Bayswater, W.2, timber merchant and importer; A. G. H. Wilson, 22a, Regent Street, S.W.1, accountant. Qualification, £50. Remuneration, £250 per annum for the chairman, and £200 each for the others, and 33⅓ per cent. of the net profits remaining in each year after 20 per cent. dividend is paid, divided between them. Registered office: 22 and 22a, Regent Street, S.W.1.

G. L. Adamson, Ltd. (192,081).—Private company. Registered August 23rd. Capital, £7,500 in £1 shares. To take over the business of an electrical engineer and contractor carried on by G. L. Adamson at Ohm Works, 116, Yorkshire Street, Rochdale, together with the buildings used in connection therewith. The first directors are:—G. L. Adamson, 23, The Green, Norden, near Rochdale, electrical engineer and contractor (permanent); H. Humphreys, 15, Grimes Street, Norden, near Rochdale, electrical engineer. Qualification, 100 shares. Registered office: Ohm Works, 116, Yorkshire Street, Rochdale.

Surrey Wholesale Electrical Co., Ltd. (192,067).—Private company. Registered August 23rd. Capital, £1,000 in 500 ordinary "A" shares of £1 each and 10,000 ordinary "B" shares of 1s. each. To take over the business carried on at Church Path, North End, Croydon, Surrey, as the Surrey Wholesale Electrical Co., Ltd. The subscribers are:—W. E. McClelland, 46, Montague Gardens, Wallington, Surrey, electrical engineer, 100 ordinary "B" shares; S. V. Gibson, 3, Queen Street, E.C.4, solicitor, one ordinary "A" share. W. E. McClelland is permanent governing director, subject to holding 100 shares. Qualification of other directors, 1 share. Remuneration as fixed by the company. Solicitors: Spencer, Gibson & Son, 3, 4 and 5, Queen Street, E.C.4.

Kartret Switchgear Co., Ltd. (192,063).—Private company. Registered August 23rd. Capital £2,500 in £1 shares. The objects are: To acquire the sole right of selling and marketing the electrical switchgear and any other electrical gear formerly manufactured by the Kartret Engineering Co., Ltd., and now manufactured by the New Switchgear Construction Co., Ltd., and to enter into an agreement with the last-named company. The first directors are:—C. E. Cleeves, J.P., Heddfan, Sketty, Swansea, colliery owner (chairman); W. W. Hughes, 12, Cambrian Place, Swansea, consulting engineer; E. S. M. Pritchard, Faircot, Camberne Road, Sutton, Surrey, manager, New Switchgear Co., Ltd.; V. G. Middleton, Mirables, St. Lawrence, I.W., electrical engineer; C. J. Baker, 6, Fontenoy Road, Balham, S.W.12, electrician. Secretary: W. A. Bates. The registered office is 7, Carteret Street, S.W.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Headphones (Manchester), Ltd.—Debenture dated August 18th, 1923, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital. Holders: Herbert Terry and Sons, Ltd., Novelty Works, Redditch.

Mills, English & Co., Ltd.—Particulars filed of £20,000 debentures authorised by resolutions of July 2nd and 31st, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £17,500.

Eclat Electric Manufacturing Co., Ltd.—Particulars filed of £6,000 debentures authorised August 10th, 1923, and covered by trust deed of even date charged on the Spencer Lamp Works, Spencer Hill Road, Wimbledon, and the company's undertaking and property, present and future, including uncalled capital, the whole amount being now issued. Trustees: F. Samuelson, 69, Lincoln's Inn Fields, W.C.; and G. E. Bruce Millar, 28a, Basinghall Street, E.C.2.

Flactem Wireless, Ltd.—H. Bottomley, of 31, Regent Park Terrace, Leeds, was appointed receiver on August 13th under powers contained in trust deed dated March 16th, 1923.

Scientific Inventions Syndicate, Ltd.—W. A. J. Osborne, of Balfour House, Finsbury Pavement, E.C., ceased to act as receiver or manager on June 30th, 1923.

Premier Electrical Engineering Co., Ltd.—Particulars filed of £300 debentures authorised August 13th, 1923, charged on the company's undertaking and property, present and future, including uncalled capital, the amount of the present issue being £200.

Wireless Installations, Ltd.—J. S. Bird, of 36/38, Victoria Street, S.W.1, was appointed receiver and manager on August 10th under powers contained in debentures dated May 3rd, 1923.

Direct Spanish Telegraph Co., Ltd. (6,732).—Return dated April 4th, 1923 (filed May 10th). Capital, £95,000 in £5 shares (13,000 ordinary and 6,000 preference). 12,931 ordinary and 6,000 preference shares taken up. £94,655 paid. Mortgages and charges, nil.

Rhondda Tramways Electric Supply Co., Ltd. (94,470).—Return dated April 26th, 1923 (filed June 7th). Capital, £100 in £1 shares. Seven shares taken up. £7 paid. Mortgages and charges, £54,000.

Banbury and District Electric Supply Co., Ltd. (65,746).—Return dated June 21st, 1923. Capital, £25,000 in £10 shares. All shares taken up. £25,000 paid. Mortgages and charges, £4,600.

British Columbia Electric Railway Co., Ltd. (51,953).—Return dated February 5th, 1923 (filed May 28th). Capital, £9,000,000 in £1,440,000 5 per cent. cumulative perpetual preference stock, £1,440,000 preferred ordinary stock, £1,440,000 deferred ordinary stock, and 680,000 shares of £1 each (unissued). £4,320,000 stock taken up. £4,120,001 15s. paid, including £1 13s. paid on seven shares forfeited. £200,000 considered as paid. Mortgages and charges, £3,089,070.

Anglo-Argentine Tramways Co., Ltd. (25,363).—Return dated July 3rd, 1923. Capital, £11,000,000 in 800,000 first preference and 720,000 second preference shares of £5 each, and 862,500 ordinary shares of £4 each. 640,000 first preference, 610,000 second preference, and 675,000 ordinary shares taken up. £8,50,000 paid. £8,100,000 considered as paid. Mortgages and charges: £70,660 annuity, £4,465,674 4 per cent. debenture stock, £1,733,380 4½ per cent. debenture stock, and £6,000,000 5 per cent. debenture stock.

Altrincham Electric Supply, Ltd (40,795c).—Return dated June 27th, 1923. Capital, £100,000 in 49,650 preference and 50,000 ordinary shares of £1 each, and 7,000 deferred shares of 1s. each. 45,000 preference, 50,000 ordinary, and 7,000 deferred shares taken up. £95,350 paid. Mortgages and charges, £77,000.

Geo. Bray & Co., Ltd. (76,185).—Return dated July 6th, 1923. Capital, £160,000 in £1 shares (80,000 preference and 80,000 ordinary). 55,000 preference and 55,000 ordinary shares taken up. £7 paid. £109,9.3 considered as paid. Mortgages and charges, £40,000.

British Thomson-Houston Co., Ltd. (47,982).—Return dated May 16th, 1923. Capital, £4,000,000 in £1 shares (2,000,000 7 per cent. cumulative preference and 2,000,000 ordinary). 1,500,000 7 per cent. cumulative and 2,000,000 ordinary shares taken up. £3,425,310 paid. £74,690 considered as paid. Mortgages and charges, £1,624,055.

Metallic Seamless Tube Co., Ltd. (47,966).—Return dated July 6th, 1923. Capital, £65,333 6s. 8d. in 20,000 preference shares of 1s. 4d., 260,000 shares of 4s. 15,245 preference, and 260,000 ordinary shares taken up. £36,163 6s. 8d. paid, being 1s. 4d. per share on 15,245 preference and 4s. per share on 130,000 ordinary. £26,000 considered as paid on 130,000 ordinary. Mortgages and charges, nil.

J. G. White & Co., Ltd. (66,568).—Return dated July 10th, 1923. Capital, £350,000 in 400,000 ordinary shares of 5s. each and 70,000 ordinary and 180,000 preference shares of £1 each. 400,000 5s. ordinary and 180,000 preference shares taken up. £200,000 paid, being £1 per share on 150,000 preference and 5s. per share on 200,000 ordinary. £80,000 considered as paid on 30,000 preference and 200,000 ordinary. Mortgages and charges, nil.

Johnson & Phillips, Ltd. (84,968).—Return dated May 18th, 1923. Capital, £700,000 in £1 shares. 437,500 shares taken up. £269,135 paid. £168,365 considered as paid. Mortgages and charges, £334,774.

Wadebridge and District Electric Supply Co., Ltd. (19,776).—Capital, £3,450 in 1,250 preference and 2,200 ordinary shares of £1 each. Return dated April 9th, 1923. All shares taken up. £490 paid on 490 preference and 100 ordinary. £2,990 considered as paid on remainder. Mortgages and charges, £850.

English Electric Co., Ltd. (152,250).—Capital, £5,000,000 in 1,500,000 preference and 3,500,000 ordinary shares of £1 each. Return dated May 9th (filed July 14th), 1923. 698,564 preference and 1,521,509 ordinary shares taken up. £315,673 paid on 315,673 ordinary. £1,904,400 considered as paid on 1,205,836 ordinary and 698,564 preference. Mortgages and charges, £2,160,900.

New Gutta Percha Co., Ltd. (74,517).—Capital, £125,000 in 50,000 preference shares of £1 each and 150,000 ordinary shares of 10s. each. Return dated May 28th, 1923. 14,100 preference and 138,250 ordinary shares taken up. £30,475 paid on 11,350 preference and 38,250 ordinary. £3,750 considered as paid on the remainder. Mortgages and charges, £30 000.

Hart Accumulator Co., Ltd. (60,059).—Return dated May 30th, 1923. Capital, £200,000 in £1 shares (180,000 ordinary and 20,000 preference). 156,708 ordinary and 19,523 preference shares taken up. £98,411 paid. £137,820 considered as paid. Mortgages and charges, nil.

CITY NOTES.

Italian Companies.

The following companies have increased their capital: Società Generale Elettrica dell'Adamello from 100,000,000 to 160,000,000 lire; Società Lombarda Distribuzione Energia Elettrica (Milan), 52,000,000 to 80,000,000 lire; Società Anonima Imprese Forniture Elettriche Ing. Beretta (Milan), 300,000 to 500,000 lire; Acciaierie Elettriche Sesto San Giovanni, reduction from 500,000 lire to 10,000 and thereafter increase to 1,000,000 lire; Società Elettro-chimica Novarese, from 3,000,000 to 5,000,000 lire; Società Generale Italiana Edison di Elettricità (Milan), from 180,000,000 to 250,000,000 lire; Officine Elettromeccaniche (Rivarolo Ligure), from 18,000,000 to 20,250,000 lire; Imprese Elettriche e Telefoniche Ing. T. Bormida (Milan), from 1,600,000 to 3,200,000 lire.

The following dividends have been declared: Società Generale Elettrica dell'Adamello, 8 per cent.; Società Nazionale per lo Sviluppo delli Imprese Elettriche (Milan), 22.50 lire per share; Società Idrolettrica Ligure Meridionale (Genoa), 24 lire per share; and the Società Anonima Forze Idrauliche di Trezzo d'Adda Benigno Crespi (Milan), 11 per cent. on its 20,000,000 lire of capital.

South Wales Electrical Power Distribution Co.

A meeting of preference shareholders and ordinary stockholders has been called for September 6th, at Royal Chambers, Queen Street, Cardiff, to consider the adoption of a proposed agreement with the South Wales Power Co., Ltd. The agreement provides for re-vesting in the company powers and right hitherto vested in and exercised by the South Wales Power Co., Ltd., under certain Acts and agreements. A majority of three-fifths of those present at the meeting, in person or by proxy, is necessary to the carrying of the proposals, and the operation of the agreement is also dependent upon not less than 85 per cent. of these stock- and shareholders agreeing to an exchange of shares.

French Companies.

Compagnie Lorraine d'Electricité.—This company has directed its operations to the electrification of the rural districts, either by securing concessions, or by connections with communal syndicates. In the past year the stations at Nancy and Vincey have been enlarged, and an increase of 25 per cent. effected in the amount of energy sold. The year closed with net profits of 3,279,889 fr. On the proposal of the board a dividend of 10 per cent. on the fully-paid shares and 6.25 fr. on the one-quarter paid up shares was declared. Details are given in the report of the various subsidiaries and other companies in which the company has an interest. The results of the working of the Société Vosgienne d'Electricité have enabled it to pay a dividend of 7½ per cent. on its doubled capital. The Energie Electrique du Meuse et Marne has paid a dividend of 8¼ per cent., and the Energie Electrique a dividend of 8 per cent. The Electricité de Saint Dié was able to distribute 10 per cent. The obligation on this company to extend its network to the outskirts led its board to propose the increase of its capital from 250,000 to 1,250,000 fr. The Société Musienne d'Electricité finished the reconstruction of its network and now supplies about 250 communes in the Valley of the Meuse, the Woëvre plain and the Valley of the Aire. A dividend of 8 per cent. net was distributed. The Société Electrique du Toulois recorded normal progress; it had taken a share in the formation of several communal syndicates. A dividend of 7 per cent. was declared.

A Hungarian Lamp Manufacturing Company.—The United Glow Lamp and Electricity Co., of Budapest, whose shares are stated to be held by a syndicate composed of the American General Electric Co., the Western Electric Co., and the A.E.G., is making a fresh issue of capital. At present the Hungarian company's lamp factory produces 76,000 lamps per day, of which 80 per cent. is exported to the Balkans and the Near East. The company is erecting a glass works at Tokoa in order to render itself independent of imports of glass from Czecho-Slovakia.

City of London Electric Lighting Co., Ltd.—The following dividends are announced for the half-year ended June 30th, 1923:—At the rate of 6 per cent. per annum on the first preference shares; at the rate of 8 per cent. per annum on the second preference shares; and 1s. per share (being at the rate of 10 per cent. per annum) on the ordinary shares; all less tax at 4s. 7½d. in the £.

Newcastle-upon-Tyne Electric Supply Co., Ltd.—Interim dividends of 3½ per cent. on the 7 per cent. cumulative preference shares and 2½ per cent. on the 5 per cent. preference shares (both less tax).

Stock Exchange Notice.—Application has been made to the committee to allow the following to be officially quoted:—

Lima Light, Power and Tramways Co.—Scrip, fully and partly paid, for £1,500,000 six per cent. first mortgage debentures.

Crossley Bros., Ltd.—The directors announce that they are unable to recommend the payment of a dividend on either the preference or the ordinary shares.

STOCKS AND SHARES.

Tuesday Evening.

It has been our practice for many years past to provide at this season a comparison of prices current, towards the end of August, against those which ruled at the beginning of the year. This is not only because the holidays are still in full swing (although drawing to a close melancholy enough for most school-children), but the time of year is convenient for looking back upon what has happened over the past eight months. In the present case, it is of peculiar interest to observe the changes in the home electricity supply shares, inasmuch as these have enjoyed such improvement, and our first table shall deal with the changes which have occurred in this department. It is worth pointing out that there are not many shares left now of a denomination higher than that of the popular £1. We take to-day's prices and match them

against those which prevailed at the end of 1921 and at the end of 1922.

Ordinary.	December, 1921.	1922.	Now.	Rise.
Brompton	6⅜	10½	2	—
Charing Cross	4⅝	7⅜	11⅛	3⅝
Chelsea	3½	6⅜	34/6	1⅛
City of London	1/16	2 1/16	2⅛	1/16
County	8⅜	1⅞	2⅜	1/16
Kensington	5⅛	8	9⅛	1⅛
London	1	2 1/16	4⅜	1 7/16
Metropolitan	3⅜	6⅛	1 5/16	1 5/16
St. James'	6⅜	9⅛	11⅛	2⅛
South London	2⅛	4⅜	1⅜	2⅛
Westminster	5⅛	7⅛	9⅜	1⅜

In the cable market, the feature is the manner in which the Eastern group has been depressed by the latest wireless scare. We vary our tables by adding the highest and lowest prices touched during the present year :—

Stock or share.	Dec. 1922.	Now.	Fall.	1923 H.	1923 L.
Anglo-American Pref.	103	101	2	106⅜	99
Eastern Extension	19⅛	17⅛	2⅛	19⅜	16 1/16
Eastern Telegraph	190⅛	173⅛	17	190⅜	160
Globe Ord.	19⅜	17⅛	1⅝	19⅛	16⅜
Great Northern	29⅛	27¼	2	30⅜	25⅜
Indo-European	85½	83½	3	87½	28⅛
Marconi	2⅛	2 1/16	+ 1/16	2⅛	2⅛
United River Plate	7⅛	6⅛	1	7⅜	6⅜
West India & Panama	⅛	1/6	8/6	10/-	3d.
Western Telegraph	19	16⅛	2⅛	19	16⅛

Marconis have been tolerably steady through the period, speculation having been dormant except on a few occasions when the market enjoyed a little activity. The subsidiaries have been firm, without attracting any special notice during the period under review.

Underground Railway stocks are better on balance. Central London ordinary is 5 points higher, and Underground income bonds at 100 show a rise of 12½. Metropolitans are 13 higher and Districts 3. There has been a good deal of speculation in both, and around Metropolitans in particular a number of rumours have been loosed from time to time. The following gives a comparative table :—

Stock or share.	December, 1921.	1922.	Now.	Rise.
Central London Ord.	51½	67	72	5
Metropolitan	26⅛	60	73	13
District	21⅛	47	50	3
Underground Ord.	2	2⅛	3	⅛
,, "A"	6/-	7/	9/-	2/-
,, Income	75½	87½	100	12½

Manufacturing shares pursue the usual quiet tenor of their way. Dividend disappointments have played their part in reducing values in some directions, and it is evident that until foreign export trade can be resumed, the potentialities of profit-making, for these undertakings, must be circumscribed by the vagaries of rates of exchange. The following movements give an idea of the trend of prices since the end of last year :—

Share.	December, 1921.	1922.	Now.	Rise or Fall.
Babcock	2⅜	3½	2⅜	—1⅛
British Aluminium	15/-	16/-	18/3	2/3
Brit. Westinghouse Pref. ...	1⅜	2 1/16	2 1/16	—
Callender's	1⅜	2 1/16	2⅜	1/16
General Electric	18/3	18/3	18/6	3d.
Henley's	29/6	46/9	2⅞	—1/1½
India Rubber	⅛	1/16	12/-	9d.

Amongst the noticeable events of the present week, the increase of the interim dividend from 4½ per cent. to 5 per cent. (free of tax) on Brompton ordinary shares, must be noticed. The effect was to put up the price to £2 xd. Bournemouth and Poole ordinary are better at 33s. bid. Chelsea shares hardened to 34s. 6d., County new ordinary are a little better at 41s., Westminsters have recovered 5s. with a rise to 9⅛.

Mexican Utilities have further improved, although there seems to be some doubt, even now, as to whether official recognition has been accorded or not by the United States to the Mexican Government. Mexican Light & Power common at 29 are 2½ higher, and the first mortgage bonds at 67½ have risen 6 points. Amongst other foreigners, Brazilian Tractions are very flat, in consequence of the further shrinkage in the value of the milreis, which has fallen to the lowest price on record. Anglo-Argentine Tramways shares recovered to a slight extent, and the British Columbia list is quiet, the only noticeable change being a fall of 2 in the preferred stock. London and Suburban Traction preference shares dropped back to 9s.

Steps are being taken by the Stock Exchange market to narrow the official quotations for cable stocks and shares. We have animadverted previously upon the absurdity, for it is nothing less, of quoting Eastern ordinary stock with a margin of ten points between buying and selling prices when no broker would ever dream of dealing at such a wide price. In the process of closing up these quotations, an appearance of dulness has been imparted to the list, which dulness, however, is more nominal than real. Westerns are, however, actually a little lower at 16¾. Great Northerns rose 15s. to 27¼. Marconis are steady at 2 5/16.

In the manufacturing group, Siemens rallied to 15s., and there are a few small rises in other miscellaneous shares. Babcock & Wilcox improved to 2¼. Edisons further rose to 5s. The rubber share market is strong, in consequence of a distinct improvement in the statistical position, coupled with news of American buying of the product. The armament list is disposed to be a little easier.

SHARE LIST OF ELECTRICAL COMPANIES.

Home Electricity Companies.

	Nom. £	Dividend. 1921.	1922.	Price Aug. 28, 1923.	Rise or fall.	Yield p.c.
Brompton Ordinary	1	12	12	2xd	+ 2/-	£6 0 0
Charing Cross Ordinary	5	9	14	11⅛	—	6 5 10
do. do. do. 4½ Pref.	5	4½	4½	4½	—	5 6 6
Chelsea	1	6	10	34/6	+6d.	5 16 0
City of London	1	14	15	2⅛	—	6 1 0
do. do. 6 % Pref. ...	1	6	6	24/-	—	5 6 6
County of London	1	8	10	2⅜	—	4 14 1
do. do. 6 % Pref. ...	1	6	6	23/9	—	5 1 1
Edmundson's Ordinary	3	Nil	7	9 7/8	—	6 0 7
do. 6 % Pref	5	12/-	6	4⅝	—	6 9 0
Kensington Ordinary	5	10	12	9⅛	—	6 11 4
London Electric	3	4	10	4⅜	+ ⅛	6 17 6
do. do. 6 % Pref. ...	5	6	6	5⅝xd	+ ⅛	5 11 7
Metropolitan	1	7	8½	11⅜	—	5 6 0
do. 4½ % Pref.	1	4½	4½	17/6	—	5 1 5
Newcastle-on-Tyne Ordinary ...	1	Nil	2½	17/-	—	2 19 10
do. 5 % Pref. ...	1	5	5	16/3	—	6 3 1
7 % Pref. ...	1	7	7	23/6	−6d.	5 19 1
6 % Pref.	10	6	6	9½	—	6 6 6
Elec. 6 % Pref. ...	1	6	6	22/-	—	5 9 1
Urban Ordinary	1	Nil	—	15/-	—	Nil
do. 5 % Pref. ...	1	2½	5	⅓	—	6 17 0
St. James' and Pall Mall ...	5	13	14½	11⅜	—	6 6 5
South London	1	7	10	1⅜	—	5 14 4
South Metropolitan Pref.	1	7	7	24/6xd	—	5 14 6
Westminster Ordinary	5	10	12	9⅜	+ ⅛	6 11 9
Whitehall Elec. Invst., 7½ % Pf.	1	7½	7½	19/9	—	7 13 10

Home Rails.

Central London Ord. Assented	Stock	4	4	72xd	—	5 11 1
Metropolitan	,,	2½	3½	73	+1½	4 15 0
do. District	,,	1	3	50	+2	6 0 0
Underground Electric Ordinary	10	Nil	Nil	8	+ ⅛	Nil
do. do. "A" ...	1	Nil	Nil	9/-	+6d.	Nil
do. do. Income Bonds	4	5	100	—		*5 0 0

Telegraphs and Telephones.

Anglo-Am. Tel. Pref.	Stock	6	6	101	—	5 18 10
do. Def.	,,	1½	34/6	23½	—	6 9 0
Chile Telephone	5	6	6	6	+ ⅛	5 0 0
Cuba Sub. Ord.	10	7	7	7½	—	9 6 6
Eastern Extension	10	10	10	17⅛	— ⅛	5 16 5
Eastern Tel. Ord.	Stock	10	10	178⅛	−1⅛	5 15 5
Globe Tel. and T. Ord.	10	10	10	17½	—	5 16 0
do. do. Pref.	10	6	6	11½	+ ⅛	5 6 6
Great Northern Tel.	10	24	22	27½	+ ⅛	8 1 6
Indo-European	25	10	7	83½	—	5 4 6
Marconi	1	25	15	2 5/16	—	6 9 10
Oriental Telephone Ord. ...	1	12	12	1½	+ 1/16	*6 3 9
United R. Plate Tel.	5	8	8	6⅛	—	*6 3 1
West India and Panama ...	10	Nil	Nil	1/6	—	Nil
Western Telegraph	10	10	10	16⅞	— ⅛	*6 0 0

Home and Foreign Trams, &c.

Anglo-Arg. Trams. First Pref.	5	5½	12½	2½	+ 1/16	9 7 4
do. do. 2nd Pref.	5	Nil	5½	2 1/16	—	11 17 10
do. do. 5% Deb.	Stock	5	5	72½	—	6 18 0
British Electric Traction Ord.	,,	4½	5	74½	—	6 13 1
do. do. 6% Pref.	,,	6	6	100½	—	5 19 0
Brazil Tractions	100	Nil	4	44	−4	9 1 10
Brit. Columbia Elec. Rly. Pcs.	Stock	5	5	86½	—	5 15 7
do. do. Preferred	,,	5	96/-	79½	−3	*6 1 0
do. do. Deferred	,,	8	127/-	69½	—	*7 3 6
do. do. Deb. ...	,,	4½	4½	80½	—	5 8 1
Lond. & Sub. Trac. 5 % Pref.	1	3½	5	9/-	−6d.	11 2 0
London United Tram. Deb. ...	Stock	4	4	61½	—	6 10 0
Mexico Trams 5 % Bonds ...	—	Nil	Nil	76	+1	6 11 4
do. 6 % Bonds ...	—	Nil	Nil	56½	—	Nil
Mexican Light Common ...	100	Nil	Nil	29	+2½	Nil
do. Pref.	100	Nil	Nil	56½	+3	Nil
do. 1st Bonds ...	—	Nil	5	67½	+ ⅝	7 9 1

Manufacturing Companies.

Babcock & Wilcox	1	15	20	2¼	+ 1/16	*4 9 0
British Aluminium Ord. ...	1	10	5	18/3	—	5 9 7
British Insulated Ord.	1	15	15	2 1/16	+ 1/16	6 8 3
Callenders	1	15	15	2⅜	—	6 6 4
do. 6½ Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Ord.	1	10	5	1/16	—	8 17 6
Edison-Swan	1	10	Nil	5/-	+3d.	Nil
do. do. 5% Deb.	Stock	5	5	65	—	7 13 10
Electric Construction	1	10	10	11½	—	6 16 1
English Electric	1	8	5	17/9	—	5 13 6
do. do. Pref.	1	6	6	19/6	—	6 5 6
Gen. Elec. Pref.	1	6½	6½	22/3	—	5 16 10
do. Ord.	1	10	5	18/6	—	5 6 9
Henley	1	15	15	2 1/16xd	—	6 11 7
do. 4½ Pref.	5	4½	4½	4⅝xd	+2/-	5 2 10
India-Rubber	1	10	—	12/-	+9d.	—
Met.-Vickers Pref.	2	8	8	2½	—	6 6 0
Siemens Ord.	1	10	10	⅞	+ 1/16	Nil
Telegraph Con.	12	20	20	25	—	*4 17 0

* Dividends paid free of Income Tax.

ELECTRICITY SUPPLY PRICES AND PROFITS.

By Hy. M. SAYERS.

(*Concluded from page* 274.)

If all the undertakings concerned were municipal, had obtained capital in the past, and could continue to do so, as municipal loans with the security of the rates against taking risks, no more need be said, though it would be prudent to grant some small additions for reserves, &c.

But this is not the case. More than half the capital of the undertakings considered has been expended by companies. They do not raise capital on the same terms as local authorities. They have no rates to fall back on in the event of loss, which makes the investment more speculative, and higher rates of interest or dividend have to be offered or promised and earned to obtain capital. On the other hand, they are under no obligation to repay the capital represented by shares, though their borrowings on debentures carry that obligation. But the facts that they are subject to compulsory purchase at certain dates, which are very close in some cases, and that the purchase payments under the 1888 Act will probably be much less than the capital expended, oblige them to accumulate reserve funds to make up the deficiency and repay the shareholders as well as their debenture holders. Hence, something more than the aforesaid "minimum surplus" may be necessary for company undertakings. Without divagating to discuss this in detail, it seems that on a very rough general estimate a total of £3,250,000 is a reasonably sufficient surplus of receipts over working expenses to cover capital charges, profits, and reserves.

If this is correct, it appears that the undertakings studied are collectively in a position to reduce their prices to an extent which would make the gross receipts on the same output about 7¾ million pounds, against the actual gross receipts of £9,027,000. This would mean an average price of 2.36d. per unit, a reduction of 14.2 per cent. A reduction of, say, 0.4d. per unit does not look much, but a reduction of one-seventh on the lighting rates, which range between 6d. and 10d. (occasionally more) would be a substantial boon.

It is certain that such a reduction would stimulate consumption and increase sales to an extent which would soon bring up the gross receipts.

This view has been acted upon by a large number of supply undertakings, as shown by the notices of reduction of prices in the columns of the Electrical Review during the last six months. In many cases these reductions were decided on before the close of the financial year, showing that the managements were well satisfied that they were justified without waiting for the final balancing of the annual accounts. A brief summary of these reductions will be found below, but, as notices of reductions come along every week, the tale is not complete.

This, however, is not the only, perhaps not the most important, lesson conveyed by the aggregate figures.

The aggregate load factor revealed is expressed by the ratio between the totals of the maximum loads, 436,000 kW, and the units sold, 787 millions.

"Maximum load" is recorded at generating stations (or distributing sub-stations), and includes distribution losses. The "units sold" are recorded by consumers' meters, and exclude most of the distribution losses. Not quite all, as there are many cases of street lighting, bulk and traction supply, where the units sold are measured at the stations.

Probably 12 per cent. is a fair average figure to deduct from the station maxima loads in order to arrive at the consumers' loads. On this reckoning the consumers' simultaneous maxima loads aggregated 383,000 kW in round figures. The consumption of 787 million units therefore represents 2,050 hours' use per annum of the maximum load. Put in the usual form, this is a load factor of 23.4 per cent. (If one takes the station maximum demand of 435,000 kW, the resultant load factor is 20.65 per cent.—1,810 hours' use of the maximum load. This is the usual way of stating the undertaking load factor. It is evidently illogical; the undertaking load factor is the ratio of maximum load to total output, both measured at the station and including distribution losses.)

It is in the improvement of this low load factor, *i.e.*, a better utilisation of plant capacity, that the great prospect of better service and lower prices lies. Evidently the spreading of capital charges and profits over a larger number of units will permit of lower prices without prejudice to the undertakers. To deal with one thing at a time, the beneficial influence of better load factor on working expenses need only be mentioned here. It is a much more complex and variable factor than capital charges, important, but difficult to treat adequately in a general way. It may be said that a regular time incidence of the load, always improved by higher load factor, is of very great assistance in lowering working expenses.

The annual use of the aggregate maximum load of 2,050 hours per annum does not mean that consumers individually use their maximum load for 2,050 hours on the average. The average use is much less, but how much less can only be certainly known in the case of undertakings which apply maximum demand indicators to all consumers. Whether there are any such undertakings is not known to the writer. There is much speculation, but little knowledge, as to the diversity factor among consumers. There are, however, indications that it is considerably in excess of unity. The figures of "connected load" cannot be regarded as other than approximate, but such as they are, they are generally from three to six times as great as the maximum load, and there can be few consumers who do not have the greater part of their connected load in use at some time or other during the year. The exceptions are probably those who have a considerable "connected load" for heating, cooking, and miscellaneous domestic purposes, as yet a small proportion.

It may be observed that factory and workshop hours of 44 per week give 2,288 hours per annum; that the lighting demand of such establishments averages about 15 per cent. of their power demand, and that the maximum power demand is rarely maintained over the whole working hours of every day. Hence, ordinary industrial power cannot be expected to give a much better load factor by itself than that now shown to exist. But inasmuch as it "sandwiches" with other loads, notably domestic lighting, it helps to bring up the aggregate load factor in a very valuable way. Tramway supply also assists very considerably. It has in itself a high load factor, but in most cases the tramway peaks do not synchronise with other load peaks; they also "sandwich" with factory and lighting loads, and together improve the aggregate more than is sometimes recognised.

The great field open to every supply undertaking is the general domestic load, of which cooking, small power applications, and, to some extent, heating, will provide the main bulk.

But it would be quite wrong to imagine that the domestic lighting field is completely occupied. There are perhaps some districts in every area of supply where this is the case, but it is doubtful whether there is even one where it is true for the whole area. In London, for example, it appears that the number of electricity consumers is only about one-eighth the number of gas consumers. This shows an enormous potential untapped business. And it may be remarked here

that there are quite large areas in the county of London, occupied by middle-class residences, where there are no supply mains, and the undertakers decline to provide them. Lighting of small houses, flats, and offices is not particularly sought after by some undertakers. They say that the metal-filament lamp has made it difficult to get sufficient revenue from such consumers to justify the capital spent on mains, services, meters, &c.

There is some truth in this argument, but it seems to be based upon a rather narrow view. If a supply is available, and is taken for lighting, it ought not to be difficult to get the consumers to see the convenience and value of other applications. The experience of a number of undertakings shows that where a well-designed and persistent effort is made, backed by an attractive tariff, the response is a good one.

An attractive tariff does not necessarily mean low prices all round. A mere reduction of price may not result in such an increase of consumption as is desired. If it has the result of increasing the maximum demand *pari passu* with the consumption, so that the load factor is not improved, the benefit to the undertaking and its consumers is not so great as it should be.

Hence, it may be said that the desideratum now is to devise and apply such tariffs as will not only increase consumption and demand, but widen the uses, spread the time incidence of the load, increase the utilisation and productivity of the capital invested; in short, improve the load factor as well as the consumption. A consideration of the tariff question from this point of view would necessarily be lengthy and probably controversial. It cannot be undertaken within the limits of this article, but the writer would like to say something about it on another occasion.

It is quite clear that the question is exercising the minds of supply engineers, committees, and boards of directors, and that a number of attempts to solve it are on trial.

One may turn now to what has been done recently in the reduction of prices. The review is confined to the current year, and it is of interest to note that even so early as January there were announcements of reductions.

In the first six months of this year, then, the Electrical Review noticed reductions of prices by 116 different undertakings. The great majority of these are municipal. Whether the companies have given less publicity to their action, or whether they have really lagged behind the municipal undertakers in reducing prices, cannot be said, but it must, in justice to them, be remembered that there are substantial reasons why they should act more cautiously than the local authorities, and that many of them—especially the smaller provincial companies—have had some very bad years to make up for.

It may be noted that one solitary undertaking—municipal—increased its charges in the period under review, and also that there were several applications to the Commissioners for consent to increase maximum charges. These cases may be regarded as an aftermath of transitory difficulties.

It is quite impossible to estimate the total effect of the reductions notified. In some cases only the new rates are given, in others the reductions are given in complex forms on multi-priced tariffs, so that even if fully explicit, one would have to know the proportions of the output to which each applies.

But a considerable number do give definite old and new rates for the maximum lighting flat rate, and, taking these together, they show an aggregate reduction of 11.7 per cent. This can only be taken as a sample indicating the order of the reductions. In the power, cooking, and heating rates, so far as they are indicated, the proportionate reductions are, on the whole, greater, ranging up to 25 or 33 per cent. Quite a number of heating and cooking rates are down to the even penny per unit. Probably some of the maximum demand and other complex tariffs come down to or below this rate for a reasonable consumption. It is noticeable that one undertaking announced two reductions in the six months, with a total cut from 190 to 160 per cent. above pre-war prices, or, say, 16 per cent. of last year's rates. In one case maximum rates are down to the pre-war level.

It is therefore clear that a large number of undertakings have already recognised that they can safely cut their prices, and that it is in the public interest to do so; and it also seems as if the 14 per cent. above suggested as a possible cut is not very far from the figures which they have adopted.

But there are some very remarkable differences in the prices after these reductions. The maximum lighting rate varies all the way from 4½d. to 11d., and the differences do not seem readily explicable by either the locality or the magnitude of the undertakings. There are quite near neighbours with prices in the ratio of 2 to 1 or thereabouts. It is no purpose of this article to make unpleasant comparisons or to mention names, but it is certainly extraordinary to find that some very large concerns are keeping their prices much above the level of some much smaller close neighbours. There may be good reasons; it is very unfortunate for their consumers, reasons good or reasons bad.

On the whole, however, it appears that fairly rapid progress, though patchy, is being made towards the pre-war level of prices. There is great activity in some quarters in popularising the more general use of electrical energy as an element of health, comfort, and relief from drudgery in our homes. It is greatly to be desired that this activity should become general. Good results follow wherever such efforts are persevered in with the necessary regard to human nature and with a reasonable amount of prudent optimism. These good results spread, benefiting the industry as a whole, and benefiting the wider public.

It is essential to this progress that a proper relation should be observed between prices and profits. Any endeavour to make large profits by keeping up prices, though it may succeed for a time, is bound in the long run to defeat itself, and in the meantime it withholds good which ought not to be withheld. It is a matter of civic concern and national concern that electricity supply should spread as rapidly as practicable, and it is submitted that this progress can be made without risk to the capital embarked in the industry.

X-Ray Examination of Strained Metals.—The *Japanese Journal of Physics* contains an abstract of Mr. Akimasa Ono's account of his X-ray interference examination of strained metals, *viz.*, copper wires (in the drawn and annealed states) low carbon steel bars (in the pulled and annealed states), &c., using the rays issuing from a Coolidge tube with a tungsten anti-cathode. The results show that the crystal lattices of metals display fibrous structures in the pulled or drawn state, the structural rearrangement proceeding as the degree of strain increases. Particularly in the case of copper of which the atoms are known to be arranged in a face-centred cubic lattice, the inclinations of several simple planes in the lattice to the primary ray and the relative intensity of diffracted rays are calculated. It is shown that the group of small crystals considered to be symmetrically arranged in such a manner that the trigonal axis of the lattice stands in the longitudinal direction of wire, gives rise to the pattern obtained in the experiment on wires drawn to a sufficient degree. It is suggested that the changes in the lattice arrangement of crystals afford a natural explanation of the change of properties observed in metals that have been subjected to strain.

The Boilermakers' Lock-out.—The boilermakers' dispute was considered at the quarterly meeting of the Federation of Engineering and Shipbuilding Trades held at York on August 22nd. It was stated that the dispute was beginning seriously to affect certain other trades, and it was decided that the Emergency Committee should communicate with the Boilermakers' Union, asking for a meeting to discuss the situation and see if some honourable settlement could not be arrived at with regard to the overtime and night shift questions. The question of the period in which unemployed insurance benefit is payable was also discussed, in view of the lost time to operatives in allied industries caused by the boiler-makers' dispute, and it was decided to approach the Ministry of Labour on the matter.—*The Times*.

CUSTOMS TARIFFS.—II.

Canada.

The general rate of import duty levied on British electrical and allied material entering Canada is 15 per cent., as will be seen from the table given below. Certain other provisions are, however, noteworthy. In respect of goods on which more than 15 per cent. is levied under the British preferential tariff a discount of 10 per cent. is allowed provided that the goods are imported direct through a Canadian port. In addition a sales tax amounting to 43⅓ per cent. of the duty-paid value is levied on importations by wholesalers or manufacturers and 6 per cent. of the duty-paid value on importations by retailers or consumers. After January 1st next the sales tax will be 6 per cent. under both headings.

British Preferential Tariff.

Electric light carbons and carbon points n.e.i.	a.v.	22½ %
Telegraph and telephone instruments, electric and galvanic batteries	,,	15 %
Electric motors, dynamos, generators and parts	,,	15 %
Insulators of all kinds, and sockets	,,	15 %
Electric cooking or heating apparatus with less than 50 % nickel-plated surface	,,	15 %
Ditto ditto, with 50% or more nickel-plated surface	,,	22½ %
Electric conduit of paper, bituminised, for insulating wires	,,	15 %
Electric meters	,,	15 %
Electric lamps	,,	20 %
Electric light bulbs, glass	,,	5 %
Electric light bulbs (small), substantially of metal, for surgical use		free
Cables, telegraph, telephone, and electric light	a.v.	17½ %
Electric light fixtures or metal parts of	,,	20 %
Electric street cars (motor)	,,	22½ %
Switchboards and switches	,,	15 %
Metallic elements and tungstic acid for use in the manufacture of metal filaments for electric lamps		free

(2) EXTERNAL MARKETS.

Brazil.

The Brazilian import tariff generally is highly protectionist. At the same time, in order to foster the establishment of local industries, it provides for the admission of various goods duty free. Among these the following will be of interest to the electrical and allied trades:—

Coal and gold mining companies may import, free of customs duty and the 2% "expediente" tax, apparatus, raw material and plant for their industries and for setting up electricity works to supply power to third parties, using as fuel only native coal or products of native coal. Other mining companies may import raw material, apparatus and plant, but the two per cent. "expediente" tax is levied on such imports.

Materials for constructing and working State Federal Railways are to be free of import duty.

Plant and accessories for fitting up factories to make paper pulp out of wood and rice straw and machines (and accessories) for making the pulp, pay only the 2 per cent. "expediente" tax.

Provision is also made for the admission of various goods at reduced rates of import duty amongst which the following may be mentioned:—

Materials necessary for power, water gas, telephone and transport undertakings run by the States, by municipalities or by companies.

A duty of 3 per cent. only is charged on machines, apparatus, &c., for experimental alcohol distillation.

The general rates on certain electrical and allied material are given in the following table. There is a surtax of 2 per cent. gold (or paper currency equivalent) which is levied on the official import valuations. Column 3 of the table shows the percentage of such official valuation which is represented by the duty (column 2). Duties are payable as to 60 per cent. in gold (or paper currency equivalent) and 40 per cent. in paper:—

		Milreis.	%
Steam engines, without boilers—			
Up to 1,000 kg.	kg.	.200	10
From 1,000 to 5,000 kg.	,,	.150	10
From 5,000 to 20,000 kg.	,,	.120	10
From 20,000 to 100,000 kg.	,,	.100	10
Over 100,000 kg.	,,	.090	10
Steam turbines—			
Up to 500 kg.	,,	.250	10
From 500 to 5,000 kg.	,,	.180	10
From 5,000 to 25,000 kg.	,,	.150	10
Over 25,000 kg.	,,	.120	10
Dynamo-electric machines, alternators, and the like, weighing—			
Up to 100 kg.	kg.	.250	10
From 100 to 1,000 kg.	,,	.200	10
Over 1,000 kg.	,,	.150	10
Dynamo-electric machines when joined to steam or hydraulic engines—			
Up to 2,000 kg.	,,	.200	10
From 2,000 to 10,000 kg.	,,	.150	10
Over 10,000 kg.	,,	.120	10
Dynamo-electric machines when joined to gas or oil engines—			
Up to 2,000 kg.	,,	.150	10
Over 2,000 kg.	,,	.120	10
Battery jars, insulators, bell pushes, &c., of earthenware	,,	.500	50
Earthenware insulators of non-uniform body	,,	.200	50
Electric lamps	,,	3.500	50
Static transformers weighing—			
Up to 200 kg.	,,	.600	10
From 200 kg. to 400 kg.	,,	.400	10
Over 400 kg.	,,	.150	10
Wire, uncovered, for electrical purposes	,,	.800	30
Wire, covered with cotton, paper or rubber	,,	.900	30
Ditto, ditto, and armoured	a.v.	20%	30

Argentina.

The position with regard to the Argentine tariff is that the Chamber has approved an increase of 60 per cent. in the valuations inscribed in the valuation tariff and an increase in the specific duties of the tariff of 25 per cent. These increases have also to be approved by the Senate which, it is anticipated, may suggest certain amendments to the Chamber's proposals.

Sweden.

The only important alterations that have been made in the Swedish customs tariff recently were those introduced in the Bill of April last year. These affected the import of luxuries and not electrical or engineering material. The rates on the latter are as follows:—

		Kr. öre
Generators motors, converters and transformers—		
Weighing not more than 50 kg. net	per 100 kg.	55.00
Weighing more than 50 kg. but not more than 100 kg. net	per 100 kg.	38.00
Weighing more than 100 kg. but not more than 500 kg. net	per 100 kg.	28.00
Weighing more than 500 kg. but not more than 3,000 kg. net	per 100 kg.	22.00
Weighing more than 3,000 kg. net	per 100 kg.	15.00
Stators, rotors, magnet coils, brushholders and armature coils when imported separately; Dutiable as electrical machines with an addition of 50 per cent. (No duty is to be levied in the case of an article which is proved to be imported as a substitute for a worn out or otherwise useless part of a machine imported previously.)		
Accumulators—		
Unmounted cells, plates, glass tubes, jars of a capacity of at least 3.5 cub. decim. for accumulators and wooden boxes lined with lead	per 100 kg.	6.00
Cells and batteries, wholly or partly mounted, also electrodes soldered together	per 100 kg.	32.00
Metallic filament lamps	per kg.	4.00
Arc lamps	per kg.	0.50
Metal filaments, carbon filaments and bases for lamps		Free
		Kr. öre
Resistances, regulators, safety appliances and switchboards	per kg.	0.95
Plugs, fuses and excess voltage apparatus	,,	0.50
Oil break switches hand operated	,,	0.30
Oil break switches, other	,,	0.55
Knife switches	,,	0.50
Other kinds	,,	0.75
(The six foregoing groups do not comprise parts of telegraph or telephone apparatus.)		
Telephone apparatus—		
Weighing less than 5 kg. net per article	per kg.	1.50
Of greater weight	,,	0.80
Telegraph apparatus telephone switches and switchboards, also parts n.e.i.	per kg.	1.50
Insulating tubing, steel armoured	,,	0.10
Insulating tubing, other, also bends and boxes	,,	0.20
Electric furnaces, cooking apparatus, stoves, &c.,	per kg.	0.18
Electric cables, covered with lead or other metal, with or without armouring—		
Of maximum diameter of 25 mm.	per kg.	0.10
Of greater diameter	,,	0.09
Signalling apparatus, Röntgen ray apparatus, &c.	a.v.	10%
Electricity meters, &c.	a.v.	10%

		Kr. öre
Wire coated with rubber or other insulating substances not specially mentioned—		
Armoured with at least 7 iron wires, each more than 1.5 mm. in thickness	per kg.	¶.15
With other iron armour or armoured with other metal	per kg.	0.25
Other kinds	,,	0.25-0.35
Wire or cable, insulated, other than the foregoing	a.v.	10%
The thickness of the wire not being greater than 0.5 mm.	per kg.	1.00
The thickness of the wire being greater than 0.5 mm.	per kg.	0.50
Wire or cable, insulated, other than the foregoing	a.v.	10%

Norway.

The Norwegian import duties on certain electrical material are shown below.

Articles marked * may be imported into Norway duty free if it is shown to the satisfaction of the Customs authorities that they are not manufactured in Norway. The Customs Department may also admit free cables, &c., which are not made in Norway. It should be noted that in June last a surtax of 33⅓ per cent. was placed on nearly all goods.

		kr.
Dynamos, motors, transformers, rheostats and safety apparatus are classed under machines, motors and apparatus for industrial or other technical purposes, not specially mentioned*	a.v.	10%
Electricity meters	,,	10%
Accumulators and parts, including cells ...		Free
Galvanic elements and parts, including cells	per kg.	0.10
Incandescent lamps	,,	1.50
Insulators—		
(1) Porcelain, high pressure	,,	0.55
(2) Porcelain, low pressure	,,	0.25
(3) Other	,,	0.06
Cables or other conductors—		
(1) Insulated, with or without braiding, textile covering, &c.	per kg.	0.50
(2) Other, including insulated lead-covered cables, with or without armouring, for laying under ground or water		Free

[Kr. (100 öre) = 1s. 2d. approx.]

Miscellaneous.

A revision of Chile's import duties is under discussion.

A revision of the Chinese customs tariff came into force in January this year. Its object was to bring the specific rates up to an effective 5 per cent. *ad valorem*. Electrical machinery and apparatus, however, are not amongst the goods on which specific duties have been levied, and the duty to be paid on all such material is still 5 per cent. *ad valorem*.

In Japan there is likely to be a general revision of import duties before very long.

In French and Belgian import duties a number of alterations are pending as a result of the Franco-Belgian convention which is not likely to be ratified until the autumn. Some of the alterations involved were referred to in our issue of June 29th.

Similarly the tariff situation in Spain is rendered uncertain owing to a recent Royal Decree, which provides for the substitution of specific rates for the *ad valorem* duties.

RUSSIAN ELECTRICAL NOTES.

There are five electric stations in the Moscow region, which are controlled by the "Moges," the Smidovitch (the former 1886 company), the tramway authority, the regional Elektroperedatch, the Pavlovsky, and the Glochovsky. Besides these stations, one or two electrical stations are included in the general system—the Schatur and the Kaschir, which are not immediately controlled by the Glavelektro. The Moges supplies energy to most of the industrial concerns of Moscow, besides current for general lighting.

The tariffs for electricity are in two groups—for lighting and industry respectively. The tariff rates have to be approved by the superior Government bureau on the basis of a fixed form for calculating the cost price. On account of the poor purchasing power of the population, the general lighting tariffs for the people are lower than the pre-war rates, whilst the deficit so created is recouped principally from private industry, &c. For the workmen of the Moscow district still greater allowances are made—up to 50 per cent.—by distributing coupons through the corresponding unions. The supply of electricity at prices considerably below pre-war charges has been made possible by an intensified economy in production, systematic improvements in equipment, the use of cheap local fuel, the strict centralisation of the commercial management, and the reduction of overhead charges to the lowest possible limit. The management of the "Moges" is reducing the consumption of petroleum as much as possible and using more local fuel in the form of peat or brown coal.

The cost of fuel for the power stations is thus steadily falling. Last year these stations could not produce the quantity of electricity required, but this year they are keeping up to the required level.

In the course of the sittings of the Central Committee of the Supreme Economic Council, a conference took place on August 7th to hear a report of the sub-committee appointed to investigate the position of the Petrotok (Petrograd Current Trust). This Trust embraces four Petrograd power stations, of which the largest and best equipped—the 1886 station—produced 62 per cent. of the total energy delivered. During the period of the existence of the Trust the capacity of this station has been increased to its original level, whereas at the end of 1922 it had been equipped up to only 52-60 per cent. of this. The 1886 station is distinguished from the other stations of the Trust also by the relatively low cost price of its supplies. Whereas at the other stations of the Trust the cost price exceeds 10 copecks per kWh, and the average cost price for all the stations of the Trust is 9.43 copecks, the price per kWh of the energy produced by this station is only 8.32 c. The pre-war cost price was 4.84 c.

The Glavelektro is claiming complete control of the purchases of electrical materials from abroad, in the interests of home industry. The chief objection appears to be the probable effect on prices of home-made goods. The objection is admitted as a reasonable one, but still the tendency is to grant the monopoly. The report on the subject showed that the electrical industry had produced goods last year to the value of 17,500,000 gold roubles—or 1½ times that of the preceding working year—but it had only sold half of its products, or about 8,800,000 roubles' worth. In January, 1923, there was 20,000,000 roubles' worth in stock, whilst in the 1922-23 working year the value of imported lamps alone was 6,800,000 r. gold. The importations had limited the sales of home-made electric lamps to 400,000 r. value, against a production of 1,800,000 r. value. The monopoly, as recommended, is to be subject to restrictions and control, it being recognised that the country will ultimately profit by the extension of the electrical industry at home. The Glavelektro is seeking to form a share company to import and export electrical goods and to do commission business, with a capital of 700,000 gold roubles.

The lamp industry of Petrograd, which is concentrated in the Svyetlana Factory, has made immense progress during the past six months, both as to increased production and improved quality. This factory started in August, 1922, with a maximum production of 1,500 lamps per day; now it is producing 7,500 lamps per day. The chief difficulty that impeded its progress in the past has now been removed, thanks to the improved quality of the wolfram and molybdenum filaments received from abroad. It may be anticipated that the Svyetlana lamps, which do not equal those of the "Osram" or "Philips" makes, will soon be quite as good as these.

It is expected that improvements now in progress in the equipment of the factory will enable the concern to turn out as many as 20,000 lamps a day this autumn, instead of the present 7,500. The improvements include the construction of a new gas factory, and the hope of 40,000 lamps per day is entertained when all the present works are completed. Great progress has been made in cheapening production; a lamp that cost 50 gold copecks in January this year now costs no more than 39 copecks, the labour in which costs from 5 to 6 copecks. Taxation amounts to from 1 to 1½ copecks, so that the balance consists of raw material and other costs.

An electrical station has been opened at Schunge, on the Volga, for the potato mills; it is a co-operative concern. At present it is lighting 42 villages within a ten verst (1 v.= 1,166 yards) radius and 16 co-operative potato mills are being driven by it. It is proposed to use the energy for agricultural purposes and electric ploughs have been employed with satisfactory results.

The Rzhev Electricity Co., capital 300,000 gold roubles, has been formed, and 55 per cent. of the capital will be Governmental. The initial capacity of the proposed station will be 500 kW and the transmission pressure 6,000 volts. Current will first be used to light the town and afterwards for power purposes.

Annealing Iron and Steel.—In a leading article *The Engineer* draws attention to the practice of annealing crane chains, &c., at intervals, in order to guard against their becoming brittle or crystallised, and points out that in the light of modern knowledge such processes are not merely useless but actually harmful. Unless plastic deformation of the material takes place to an extent that could not fail to be detected by any reasonable system of inspection, hardening cannot occur. Vibration and fatigue do not result in any change of the internal crystalline structure, and the old plea of "crystallisation" is quite unfounded. Alternating stresses of sufficient severity do bring about internal changes, but can hardly occur in chains, hooks, gas cylinders, &c. Moreover, the ordinary method of annealing iron and steel is detrimental to the material; true "normalising" improves the material, but once done should not be repeated. "Annealing, at all events as at present practised, can only result in a false sense of security where no really increased security exists."

HEAVY-CURRENT SWITCHGEAR.

A Large Ferguson, Pailin Circuit Breaker.

Under certain circumstances when the load is concentrated near the generating station and comprises a large number of small motors, large low-pressure generating sets are considered to be a commercial proposition. The heavy current produced by such sets, however, introduces problems for both the machine and switchgear manufacturer; it is therefore of

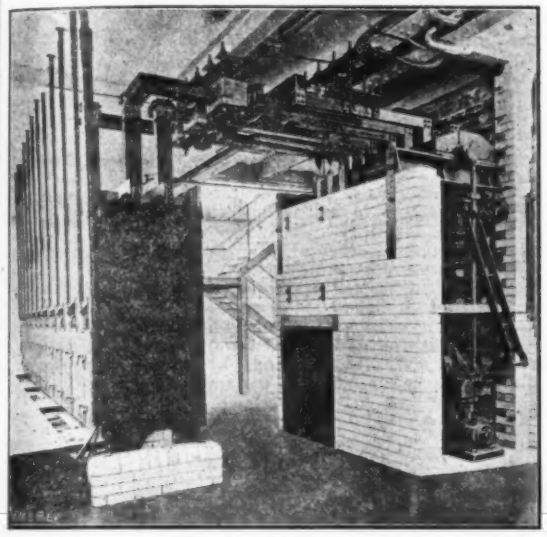

Fig. 1.—Complete Installation.

interest to note that in a recent installation in a large textile factory in Scotland both problems have been satisfactorily solved in the development of an alternator and oil circuit-breaker capable of generating and controlling 7,150 kVA at a 3-phase, 50-cycle pressure of 525 volts.

The oil breaker designed for this duty is said to be the heaviest, so far as current-carrying capacity is concerned, that has been installed in the world. It is capable of passing an alternating current of 10,000 amperes at 50 periods, or 12,000 amperes at 25 periods continuously, the former figure corresponding to the capacity of the machine installed with an allowance of 25 per cent. overload.

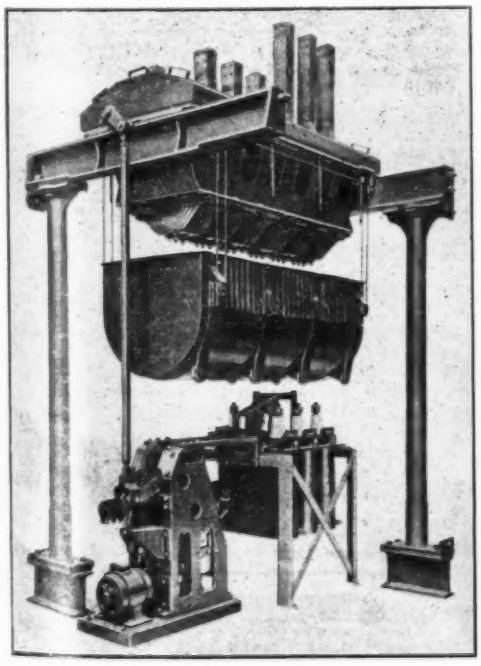

Fig. 2.—Combined Breakers with Motor Operating Gear.

In order that all the copper employed shall do useful work the current-carrying parts have been split up into small sections; this design not only reduces the losses through skin effect, but also allows the oil to percolate through the mass of metal and thus assist in cooling it. To neutralise so far as is possible the external magnetic fields the main breaker is split up into two sections, the three phases in each section being kept together; this arrangement virtually divides the switch into two 5,000-ampere, 3-phase sections operating together on one common shaft.

Messrs. Ferguson, Pailin, Ltd., have employed the same principle in designing this switch as they use for their standard 6,000-ampere oil-breakers—namely, the provision of two circuit breakers operating in parallel. A main breaker carries the current and a snap breaker performs the opening and closing operations, the necessity for which arrangement becomes apparent when the enormous weight of the main moving element (more than half a ton) is appreciated. Fig. 2 shows the combination of the two breakers together with the motor operating gear.

The complete breaker is supported from one main casting of non-magnetic material. The connections leading in and out of the breaker are of the laminated strip type and are led right through the breaker and sweated and riveted into solid sectionalised copper blocks, which form the fixed contacts. The breaker contacts are mounted on the under side of the main frame and insulated with bakelite. Despite the fact that current has not to be broken on the main breaker, arcing contacts are provided on both the fixed and moving elements. The moving contacts are lifted by means of four cams and rollers, the external operating shaft taking the remote operating lever; and all moving mechanism, with the exception of the external operating shaft, runs under oil.

The main tank is built of sheet brass plates. The main breaker is illustrated in fig. 3.

The snap breaker is a standard 1,200-ampere switch of high rupturing capacity. The connecting conductors between it and the main breaker are so arranged that any attractive or repulsive forces occurring on short circuit tend to bend the conductor on edge.

Local conditions in the particular instance under consideration did not permit of direct-current closing solenoids being used, and motor-operating gear was resorted to. The decided operation given by this apparatus is absolutely necessary, as the breaker is required for synchronising purposes.

The photograph reproduced in fig. 1 shows the installation on site of this large switch, together with the connections to the distribution board and to the alternator. The brick and concrete cell is provided so as to eliminate any heating due to external magnetic fields and the main breaker is mounted high up and as nearly in line with the machine connections as possible. The various connections are laminated and interleaved to get the maximum contact area.

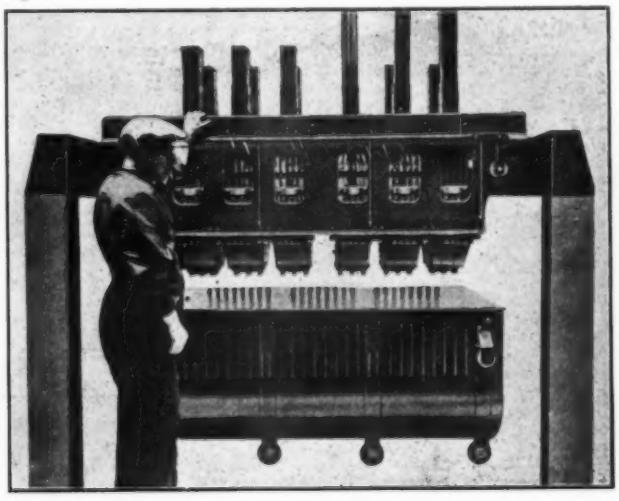

Fig. 3.—Main Breaker.

The circuit breaker described has been in commission several months and is remarkably quick in operation, the temperature rise being also considerably below that stipulated in the B.E.S.A. specification. The fact that a repeat order switch is now being constructed indicates the satisfactory performance of the unit.

THE BROOKS SAYERS DYNAMO.

Involute Helical Strip Inductor Cylinder and Subdivided Free Core.

Mr. W. Brooks Sayers informs us that considerable progress has been made with his new type of dynamo, or, as he prefers to call it, the "Dymagno-Electric" machine. It is obvious, he says, that in the term dynamo-electric one essential and dominating element is ignored, *i.e.*, magnetism. The term dymagno-electric euphoniously combines the three operating elements: mechanical force and energy, magnetism, and the magnetic field, and the electric flow or current.

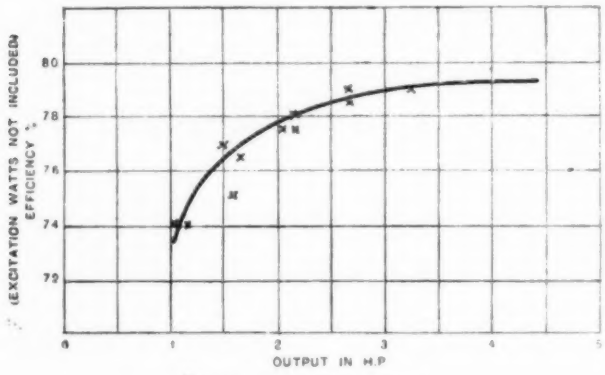

Fig. 1.—Efficiency Curve.

Since the article which appeared in the Electrical Review of September 8th last, further tests have been made with the original inductor cylinder machine, and the output and temperature rise have been determined to a higher value. The efficiency curve is shown in fig. 1; sectioned views of the inductor cylinder are given in figs. 2 and 3.

Two 25-kW (nominal) machines are being built to the designs of Mr. Brooks Sayers and under his supervision by the Speedwell Press Co., Letchworth, for test purposes, and other small machines, with inappreciable commutation ripple, are also being constructed.

Fig. 4 represents a developed view of the elements of the helical strip "winding" and field poles. The extensions on the left form the commutating surface. The elements of winding which surround the field poles are in the neutral or commutation zone, those passing through the centres of the field poles are generating e.m.f. Fig. 5 represents a section of the cylinder with the internal and external field poles in mid-position. The elliptical holes and also the three small holes slanting from the "crutch" are in the iron only; their purpose is to minimise partially stray field which tends to traverse the strips longitudinally and pass from the upper to the lower, especially at the solid end. This stray field is shown at a maximum in the group of sections, fig. 6. (The iron strips in the two-pole example, figs. 2 and 3, of which test results are given (fig. 1), have similar holes on the lines E F, fig. 2.) The section of cylinder in fig. 5 represents the aggregate of sections of helical strip which cut the paper surface at an angle of 45 deg. in opposite senses taken from the "crutch" to the right. In fig. 6 the sections are supposed to be taken along the helical surface of the top strips (drawn straight for convenience); the lower strips therefore appear in section. The series of figures represents succeeding sections through the field poles on the plane of the upper strip and shows how the strips enter the field first at one end, *i.e.*, left hand in the figures, and move endways relatively to the pole, leaving it at the right-hand end. The top figure represents a strip in the neutral zone, so parts of both poles are shown, in broken lines.

With regard to excitation it is stated that notwithstanding the increased number of air-gaps the relation of excitation expenditure to output will be much less with the new design than with the short-air-gap interpole machines of present practice.

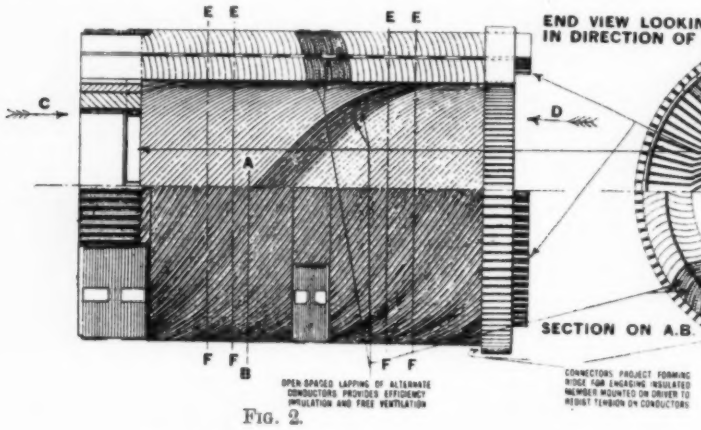

Fig. 2.

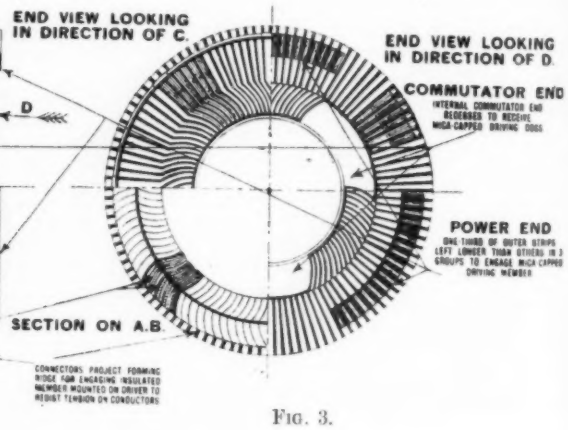
END VIEW LOOKING IN DIRECTION OF C
END VIEW LOOKING IN DIRECTION OF D
COMMUTATOR END
INTERNAL COMMUTATOR END RECESSED TO RECEIVE MICA-CAPPED DRIVING DOGS
POWER END
ONE-THIRD OF OUTER STRIPS LEFT LONGER THAN OTHERS IN 3 GROUPS TO ENGAGE MICA-CAPPED DRIVING MEMBER
SECTION ON A.B
CONNECTORS PROJECT FORMING RIDGE FOR ENGAGING INSULATED MEMBER MOUNTED ON DRIVER TO REDUCE TENSION ON CONDUCTORS

Fig. 3.

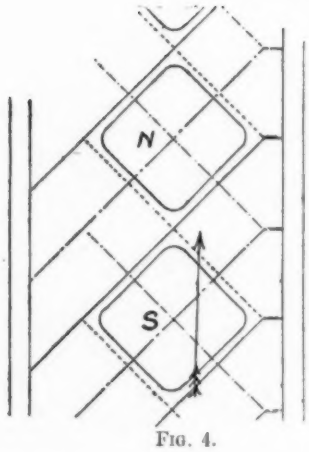

Fig. 4.

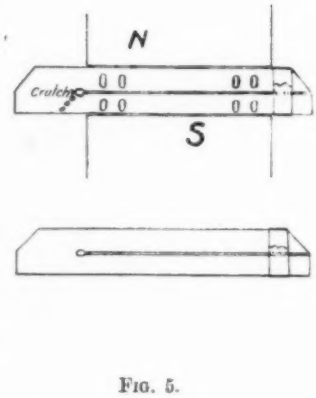

Fig. 5.

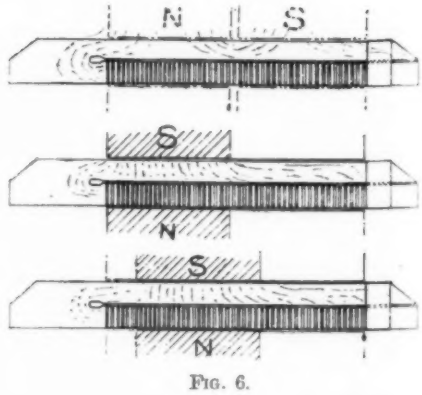

Fig. 6.

A test of Mr. Sayers's experimental armature has been made at Faraday House with the Duddell oscillograph, and the result is shown in oscillograms, one without load on the armature and the other when loaded, *i.e.*, generating current. Unfortunately these are not suitable for reproduction. Very slight oscillations are seen, the frequency of which corresponds with that of commutation and is between 4,000 and 5,000 per

second. Mr. Sayers informs us that by suitable modification of the design the amplitude and intensity of oscillation can both be further reduced and the periodicity increased in small machines at least to 40,000 cycles per second, which is above the value of the highest audible note.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Readers are invited to submit particulars of new or improved devices and apparatus, which will be published if considered of sufficient interest.

"Masco" Ignition Plugs.

Mr. M. S. Mason has designed two new forms of plug for the ignition of gas engines which are claimed to dispense with the frequent renewal of points, which is so often necessary, and to obviate a great deal of work. They are designed purely from a gas engine point of view, to withstand high temperatures and heavy electrical discharges without being damaged. The bodies of the plugs are made of steel, which will not corrode, and is practically stain-proof.

One pattern is made for general purposes and will "stand up" to hard working conditions. The other is designed for special purposes where the gas is dirty and "shorting" is found to take place with the other type of plug. The special pattern is similar to the other type but it has a mushroom-

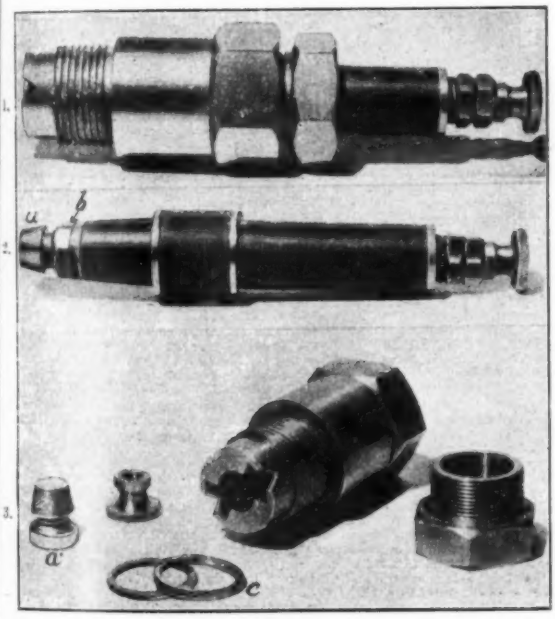

Fig. 1.—The "Masco" Plug.
Fig. 2.—Central Electrode.
Fig. 3.—Other Components of Plug.

shaped head and firing takes place on a sharp edge. The head is made of special malleable steel and re-setting is effected by hammering out the head. The head is made renewable by a special joint, so that new heads can be fitted when required without renewing the whole of the central electrode. The ordinary type is illustrated in fig. 1, the central electrode in fig. 2, and the other components in fig. 3. In this type a tapered head (*a*, figs 2 and 3) is fitted; this is also renewable at *b*. Re-setting is effected by inserting or extracting brass washers (*c*, fig. 3). The rights for these plugs have been acquired by the Smithbrook Engineering Co., Chapel-en-le-Frith, which has put them on the market.

Factory Heating on the "Unit" System.

Although not electrical, the improved "Unit" system of heating factories and workshops, evolved by Messrs. Davidson and Co., Ltd., Belfast, possesses points of interest to manufacturing readers.

The system involves the installation of a number of independent units, each comprising a heating element enclosed in a strong, sheet steel casing, at the top of which is mounted a propeller fan which blows the air downwards through the heater and distributes it near the floor level. The units, which employ steam as the heating medium, occupy very little floor space, and can be placed exactly where the heat is required. No air ducts, which often obstruct the light, and in some cases would interfere with the overhead gear of the shop, are required, and the temperature can be regulated at each unit so that no heat is wasted by overheating some portion of the building in the effort to maintain a desirable temperature in some other portion. Hitherto, the usual practice has been to operate the propeller fan by an electric motor, or to drive it by means of a belt from shafting. This involved, in the one case the necessity of running electric cables to each unit, or in the other case having to place the unit in a congested area in proximity to existing shafting. In the new unit, however, the fan is operated by a small steam turbine. The steam required for heating purposes in the battery is first admitted to the turbine, when, having performed its work of driving the fan, it passes out as exhaust steam into the heating battery, and is the only steam from which the heat is derived. Consequently this unit not only does away with the necessity for electric wiring or the use of belting, but provides fan-driving power *gratis*. The turbine, which is of very robust construction and is of the impulse velocity type, is designed to work with any specific pressure between the limits of 105 lb. and 16 lb. pressure per square inch. The turbine spindle on which the propeller fan wheel is mounted, is carried in two ball bearings and enclosed in a dust-proof housing, rigidly secured to the turbine casing. The bearing next to the turbine is protected from steam and water by a labyrinth gland of simple but effective design.

No reducing valve is required with this unit, as the turbine acts in that capacity, and, on account of complete condensation taking place in the heating batteries, the use of steam traps is obviated. This unit raises a large volume of air through a moderate temperature, giving an output of approximately 180,000 B.th.u. per hour with the fan operating at about 1,000 r.p.m.

The Macadie Automatic Coil-winder.

A new automatic coil-winding machine has been invented by Mr. Donald Macadie, a Post Office engineer. The machine, several of which we understand are giving satisfaction at the G.P.O., is small in size and is made to wear, all the principal revolving parts having ball bearings. It will automatically wind coils of any size up to 5 in. in length, whether round, flat, rectangular, or irregular in shape, at any desired speed up to 6,000 r.p.m. It will wind wire of any size, from 1 to 18 mils, evenly and tightly at any desired tension close up to the coil cheeks, without risk of damage to the wire.

The machine measures the length of the wire used, and automatically stops when the length corresponding to the desired resistance is reached. Should a break occur in the wire, or the reel be used up, the machine likewise automatically stops, the loose end of the wire already wound on the coil being held in position by a pad. The machine is provided with a starting switch, which has a stop and four speed positions; it may, therefore, be run at any desired speed. For double winding an extra arm is provided to carry the second wire; should either wire break, the machine automatically stops.

The method of fixing the coils and reels in the machine ready for winding is extremely quick and simple. The time required for correctly setting the machine to wind any length of wire, or any size of wire on to any length of bobbin, is said to be less than 10 seconds.

From a printed table provided, the length required for resistance "settings" can be readily obtained; the machine is practically noiseless in working, and there is no wastage of wire.

The machine is a great labour saver, owing to its high speed and to the fact that, whilst winding, no attention is necessary, thus enabling the operator to prepare bobbins for winding and finish off those that have been wound. One operator could, if necessary, run two machines. The machine is self-contained, and is delivered ready for use, on connection to an electricity supply by means of a two-way plug. The operator need have no previous experience; on the contrary, a few hours' training is all that is necessary to attain proficiency.

The machines are being marketed by the Automatic Coil Winder and Electrical Equipment Co., Ltd., of Wellington House, Buckingham Gate, S.W.1, and in order to bring them within the reach of the smallest manufacturer it has been arranged to let machines out on hire—a somewhat unusual but enterprising innovation so far as this sort of plant is concerned.

Japan's Electrical Exports.—From figures recently published in the *Indian Importer and Exporter* it is seen that during 1922 electrical machinery to the value of yen 3,027,587 was exported—a decline from the previous year's figure. Exported insulated wire increased in value to yen 7,816,210, practically the whole of it being supplied to China, to which country also most of the electrical and textile machinery was exported. Electric lamps at yen 1,244,423 failed to regain the heights attained in 1917 and 1921, but they were more generally distributed. There was a large decrease in the value of telephones exported, the total being yen 119,032.

NEW PATENTS APPLIED FOR, 1923.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. Sefton-Jones, O'Dell and Stephens, Patent Agents, 285, High Holborn, London, W.C. 1.

20,507. "Wireless receiving device." E. V. Appleton. August 13th.
20,516. "Electric junction box." S. J. Bryce and Callender's Cable and Construction Co., Ltd. August 13th.
20,517. "Electric wiring systems." S. J. Bryce and Callender's Cable and Construction Co., Ltd. August 13th.
20,529. "Grid leaks and anode resistances." A. M. Chalmers. August 13th.
20,536. "Searchlights, &c." A. K. Toulmin-Smith. August 13th.
20,561. "Vacuum tube and method for producing predetermined rays." L. Winkelmann. August 13th.
20,575. "Thermionic valves." A. J. Garrod and S. Radcliff. August 13th. (Australia, January 24th.)
20,586. "Insulators." British Thomson-Houston Co., Ltd. (General Electric Co.). August 13th.
20,588. "Electric sound amplifying apparatus." Sir C. S. Forbes. August 13th.
20,594. "Electric batteries." K. Katsumori. August 13th.
20,596. "Electric watch." M. P. Favre-Bulle. August 13th. (France, August 11th, 1922.)
20,597. "Striking mechanism for electric clocks." M. P. Favre-Bulle. August 13th. (France, August 11th, 1922.)
20,604. "Horns for reproduction of sound." Marconi's Wireless Telegraph Co., Ltd. August 13th. (United States, September 9th, 1922.)
20,606. "Holders, &c., for crystals of wireless apparatus." R. F. Tunmer. August 14th.
20,609. "Means for preventing short circuiting at sparking coil connections in motor vehicles." G. A. Gregory. August 14th.
20,624. "Wireless telegraph, &c., apparatus." N. A. Brydon. August 14th.
20,636. "Incandescent electric lamps." R. Caparros. August 14th.
20,637. "Starters, &c., for electric motors." Electric Control, Ltd., and O. Ellefsen. August 14th.
20,643. "Switching devices." Western Electric Co., Ltd. (Western Electric Co., Inc.). August 14th.
20,647. "Crystal holders, &c., for wireless receiving sets." H. Lyons. August 14th.
20,664. "Telephone systems." Coventry Automatic Telephones, Ltd., and C. W. Wilman. August 14th.
20,665. "Telephone systems." J. E. Collyer and Coventry Automatic Telephones, Ltd. August 14th.
20,670. "Electric overload circuit breakers." R. A. R. Bolton and English Electric Co., Ltd. August 14th.
20,679. "Electric sign." British Oil & Cake Mills, Ltd., and S. R. Lines. August 14th.
20,686. "Emergency device for electric lamps." D. Holt. August 14th.
20,699. "Electric soldering or welding tool." L. Lombardi. August 14th.
20,700. "Electromagnetic ovens for treatment of composite metals and alloys." L. Lombardi. August 14th.
20,702. "Wireless receiving apparatus." Compagnie pour la Fabrication des Compteurs et Matériel d'Usines à Gaz. August 14th. (France, September 4th, 1922.)
20,711. "Multi-core electric cables." A. W. Williams. August 15th.
20,712. "Telegraph printer." D. Murray. August 15th.
20,722. "Electric switch, &c." C. M. Pattison. August 15th.
20,725. "Electrolytic rectifiers for alternate currents." R. F. Bossini. August 15th.
20,744. "Continuously loaded submarine cables." Western Electric Co., Ltd. August 15th. (United States, February 7th.)
20,746. "Electric safety fuses." W. Hickel and O. Pletscher. August 15th.
20,762. "Electrically operated brakes." Express Lift Co., Ltd., and J. H. Meacock. August 15th.
20,768. "Induction motors." British Thomson-Houston Co., Ltd. (General Electric Co.). August 15th.
20,770. "Thermostatically-controlled throttling devices." W. E. Ernst. August 15th. (Germany, August 15th, 1922.)
20,778. "Electromagnets." J. Anderson and G. Ellison. August 15th.
20,783. "Variable electric condensers." G. W. Heath. August 15th.
20,786. "Condenser terminal." E. Pfiffner. August 15th. (Germany, August 15th, 1922.)
20,797. "Electric inductances." P. L. Davies and T. Woods. August 16th.
20,802. "Switchboard for wireless receivers." A. C. McLachlan. August 16th.
20,812. "Apparatus for transmitting, &c., photographs by wireless telegraphy, &c." J. Wilson. August 16th.
20,815. "Electric motors for planing machines, &c." J. G. Stirk. August 16th.
20,818. "Variable resistance." R. Pritchett. August 16th.
20,819. "Inductance coils." R. G. Cave. August 16th.
20,827. "Wireless receiving apparatus." P. Atkins. August 16th.
20,828. "Tapped plug-in coil." Burne-Jones & Co., Ltd., and F. Foulger. August 16th.
20,830. "Illuminating apparatus." K. A. B. Gilfillan. August 16th.
20,834. "Electric circuit breaking and making devices." C. W. Hirst. August 16th.
20,844. "Electric circuit arrangements." H. P. T. Lefroy. August 16th.
20,856. "Electric coils." P. W. Harris. August 16th.
20,858. "Wireless telegraph, &c., apparatus." G. R. Willans. August 16th.
20,859. "Electricity meters." Landis & Gyr Akt. Ges. August 16th. (Switzerland, August 18th, 1922.)
20,860. "Electricity meters." Landis & Gyr Akt. Ges. August 16th (Switzerland, August 18th, 1922.)
20,862. "Arch for electric railways." Soc. des Grands Réseaux Electriques. August 16th. (France, September 5th, 1922.)
20,863. "Control systems for motors of electric railway, &c., vehicles." Metropolitan-Vickers Electrical Co., Ltd., and N. E. North. August 16th.
20,865. "Coating compositions." British Thomson-Houston Co., Ltd. (General Electric Co.). August 16th.
20,868. "Inert galvanic cells." I. Jascourt, H. D. Pattinson, J. Rose, and Seal Co. (London), Ltd. August 16th.
20,896. "Electrically-controlled cloth guiders, &c." A. Wood and G. Wood. August 17th.
20,907. "Inductive train control." H. A. Thompson. August 17th.
20,911. "Point or cross-over for tramway, &c., rails." C. J. M. Mancor. August 17th.
20,915. "Telephone appliances." A. L. Soloman (L. A. Soloman). August 17th.
20,922. "High voltage insulator for electric gas purifiers, &c." Lodge-Cotterel, Ltd. (Metallbank und Metallurgisch Ges.). August 17th.
20,927. "Thermostatic switch." I. V. Svensson. August 17th. (Sweden, August 18th, 1922.)
20,937. "Electric switchgear." S. J. Gerrett, Seaton Delaval Coal Co., Ltd., and J. D. Shaw. August 17th.
20,941. "Thermionic valve circuits." C. H. T. Pelmear. August 17th.
20,942. "Thermionic valve circuits." C. H. T. Pelmear. August 17th.
20,944. "Electric switches." J. Etchells and Vickers, Ltd. August 17th.
20,951. "Mouldable insulating compositions." R. H. Abrey and G. S. Ferdinando. August 17th.
20,965. "Thermionic devices." F. W. Brown and G. La V. Gelsey. August 17th.
20,966. "Thermionic devices." F. W. Brown and G. La V. Gelsey. August 17th.
20,975. "Automatic cut-outs for alternating-current circuits." F. B. Co. August 18th.
20,977. "Electric lamp casing." A. H. Crouch and D. Morgan. August 18th.
20,984. "Aerial earthing plug." J. R. Hoult. August 18th.

PUBLISHED SPECIFICATIONS.

The numbers in parentheses are those under which the specifications will b printed and abridged, and all subsequent proceedings will be taken.

1922.

2,778. "Process of and apparatus for electrically steering movable objects at a distance." Soc. Industrielle des Procédés W. A. Loth. October 19th, 1921. (187,198.)
6,239. "Thermionic generators of high frequency electric oscillations." E. Green. March 2nd, 1922. (201,585.)
8,825. "Systems of reception for modulated wave telegraphy and telephony." E. Y. Robinson. March 28th, 1922. (201,591.)
8,848. "Electro-magnetic friction clutches specially applicable to reversing gearing." H. T. Boothroyd. March 28th, 1922. (201,592.)
9,419. "Electric switches for use in motor road vehicles." N. A. Dinsdale and J. W. Coward. April 1st, 1922. (201,594.)
9,560. "Devices for recording telephone calls." L. A. Gomersall and J. S. Ross. July 8th, 1922. (201,599.)
10,038. "Multiplex telegraphy." F. E. Pernot and L. J. Rich. April 8th, 1922. (201,603.)
12,067. "Means for drawing attention to the position of the switch in the ignition circuit of an internal-combustion engine." A. G. Benstead and Rotax (Motor Accessories), Ltd. April 29th, 1922. (201,615.)
12,363. "Electric incandescent lamps." British Thomson-Houston Co., Ltd. (General Electric Co.). May 2nd, 1922. (201,629.)
12,386. "Power plants." S. Klech. May 2nd, 1922. (201,632.)
12,401. "Electric welding or heating machines." E. Schröder. May 2nd, 1922. (201,633.)
12,473. "Electric lighting fittings." F. P. Fletcher. May 3rd, 1922. (201,638.)
12,508. "Electrically propelled vehicles." Industrial Appliances, Ltd., and J. E. Hamilton. May 3rd, 1922. (201,641.)
12,714. "Device for cleaning sparking plugs." M. Viterbo. May 8th, 1922. (201,651.)
12,880. "Lamps used on motor road vehicles for signalling purposes." E. W. Parrish. May 6th, 1922. (201,659.)
13,055. "Sound amplifiers for acoustic apparatus." Telegraphie Ges. System Stille, and Dr. C. Stille. May 9th, 1922. (201,660.)
13,080. "Manually operated controllers for electric traction and other electric systems or apparatus." R. G. Cunliffe, R. Brooks, and Metropolitan-Vickers Electrical Co., Ltd. May 9th, 1922. (201,662.)
14,190. "Electric relays." F. Aldendorff. May 19th, 1922. (201,679.)
14,489. "Starting and controlling apparatus for electric motors." A. H. Railing, C. C. Garrard, and W. Wilson. May 23rd, 1922. (201,684.)
14,611. "Automatic electric circuit breakers." English Electric Co., Ltd., and R. A. R. Bolton. May 24th, 1922. (201,687.)
15,765. "Means for insulating and protecting electric wire or cable joints." G. W. Humphrey. June 6th, 1922. (201,703.)
17,163. "Manufacture of refractory metals such as tungsten or the like." General Electric Co., Ltd. July 13th, 1921. (183,120.)
17,335. "Telephone exchange systems." Western Electric Co., Ltd. (Western Electric Co. Inc.). June 23rd, 1922. (201,713.)
17,427. "Induction systems of internal-combustion engines." S. L. Bailey. June 24th, 1922. (201,715.)
17,703. "Electrical variable condensers." A. E. Chapman. June 27th, 1922. (201,720.)
17,866. "Electric switches." J. A. Crabtree. June 29th, 1922. (201,724.)
17,888. "Method and means for obtaining intermittent unidirectional currents of electricity from alternating currents." A. Barnett. June 29th, 1922. (201,725.)
18,724. "Electric motor converter sub-stations." T. W. Ross, C. Ryder, and Metropolitan-Vickers Electrical Co., Ltd. July 7th, 1922. (201,732.)
18,792. "Electrically heated ovens or the like." British Thomson-Houston Co., Ltd. (International General Electric Co., Inc.). July 8th, 1922. (201,733.)
18,917. "Cathodes of electric discharge tubes." Ges. für Drahtlose Telegraphie. July 11th, 1921. (182,817.)
19,060. "Distributing apparatus for alternating electric currents for use in signal receivers and for other purposes." Siemens & Halske Akt. Ges. September 13th, 1921. (186,032.)
19,381. "X-ray apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). July 14th, 1922. (201,741.)
19,702. "Device for opening and closing electric circuits or contacts." W. H. Scott and A. Wyatt. July 18th, 1922. (201,748.)
20,022. "Form of detector galvanometer." E. E. Moore. July 21st, 1922. (201,753.)
22,754. "Diaphragms, particularly for telephone receivers." R. H. Marriott. August 21st, 1922. (201,782.)
23,166. "Automatic circuit-breaking device." E. Johnson. August 25th, 1922. (201,788.)
23,235. "Pneumatically-operated electric controllers." British Thomson-Houston Co., Ltd. (General Electric Co.). August 26th, 1922. (201,789.)
23,824. "Electric batteries." F. A. Freeth and L. A. Munro. September 2nd, 1922. (201,794.)
25,234. "Contact regulating devices." Western Electric Co., Ltd. November 25th, 1921. (189,425.)
25,440. "Methods for insulating the coils of static transformers." V. E. Sostène. September 20th, 1922. (201,802.)
27,275. "Apparatus for fixing spool heads on electromagnet cores." C. Brandes Inc. August 11th, 1922. (201,810.)
27,867. "Variable condensers for electrical purposes." H. Saville and C. H. Thornton. October 14th, 1922. (201,816.)
32,515. "Casings for electrical apparatus." British Thomson-Houston Co., Ltd. (General Electric Co.). November 28th, 1922. (201,835.)
33,358. "High tension electric transformers." E. Pfiffner. December 6th, 1921. (190,153.)
33,735. "Electric heating stove." F. Hoppe. December 11th, 1922. (201,841.)
35,182. "Electrical condensers." W. Dornig. December 27th, 1922. (201,845.)

1923.

2,727. "Electric lamp fittings." M. J. Archer. January 30th, 1923. (201,856.)
3,699. "Means or couplings for connecting aerials to radio apparatus or for connecting together other electrical conductors." A. C. Greene. February 7th, 1923. (201,859.)
6,615. "System of long-distance telephony." B. E. D. Kilburn (Naamloose Vennootschap de Nederlandsche Thermo Telephoon Maatschappij). March 7th, 1923. (201,865.)
7,436. "Sealing-in machines for electric lamp bulbs and the like." British Thomson-Houston Co., Ltd. April 24th, 1922. (196,591.)
16,678. "Controllers for electric traction and other electric systems or apparatus." R. Brooks, W. T. Gray, and Metropolitan-Vickers Electrical Co., Ltd. May 9th, 1922. (Divided application on 13,082/22.) (201,871.)